HNOLOGY DEPARTMENT
The Chemical Age

VOL LXI 6 AUGUST 1949 No 1569

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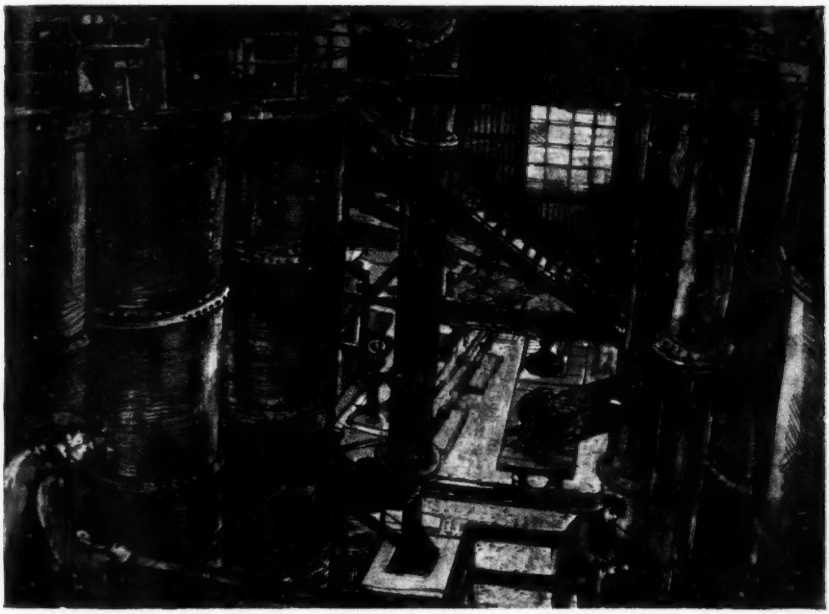


Key chemical

OUR ILLUSTRATION shows one section of the square mile of our Avonmouth works. Here—and at our Seaton Carew, Swansea and Newport factories—we produce sulphuric acid in quantities which rank us among the largest sulphuric acid producers in Europe.

One of our special points of pride, by the way, is that in 1939, when war jeopardised supplies of imported vanadium catalyst, we were able to step up production of our Imperial Smelting Corporation catalyst and to supply this first-rate British product to so many other sulphuric acid manufacturers.

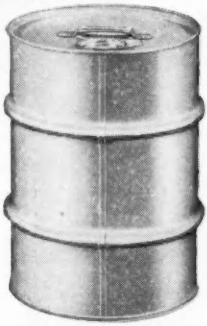
IMPERIAL SMELTING CORPORATION LIMITED

37 Dover Street London W1

MORE PROGRESS in DRUM DESIGN—

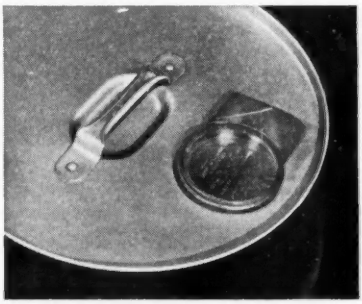
Most users of metal containers are aware that READS of LIVERPOOL have always striven to progress in matters relating to packaging design.

We now announce three further innovations in drum design.



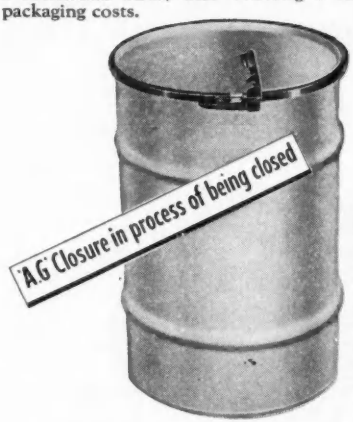
New locked-seam roller hoop drum

The incorporation of pressed-out roller hoops in tinplate and terneplate, locked side-seam drums —a major development—adds considerable strength, increases rigidity and makes for greater resistance to damage. Drums may, therefore, be used in lighter gauges than have been normal, on a returnable basis, thus effecting a saving in packaging costs.



New patented handle

The new handle with smooth turned back edges prevents chafed and cut hands even when carrying a heavy drum. The appearance is greatly improved and the strength and rigidity considerably increased.



New double-secure "A.G." pattern hoop closure

The new patented A.G. hoop is a major development in closure design for the larger full aperture drums. Neat in appearance, it has minimum projection and thus facilitates the rolling and stacking of drums and reduces the risk of damage. It can be opened by a simple upward motion and is snap-closed without the use of tools. It incorporates a special tightening link and further, it will remain securely closed, even if the rivets are accidentally broken by rough handling.

—BY READS OF LIVERPOOL

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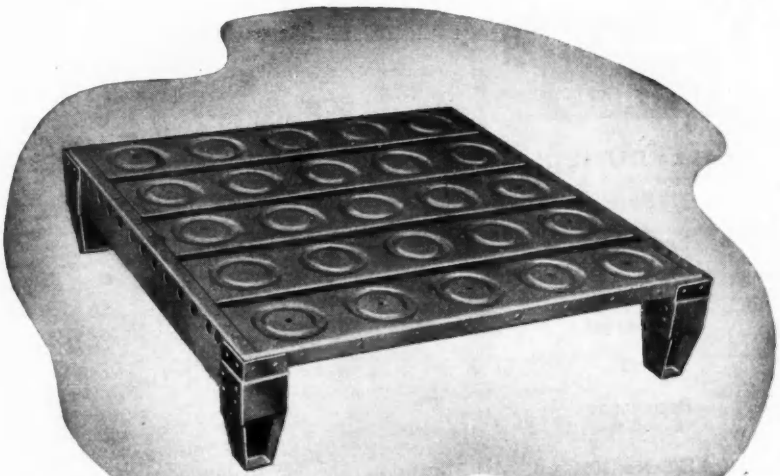

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The
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Germany's Non-Ferrous Metals

FROM the shock and chaos of the surrender in 1945, the German metal industry—miners, smelters and semi-fabricators—passed into a state of coma and inactivity. The enormously inflated currency being practically worthless and the metal prices being pegged by the Control Commission on the 1938 levels, regardless of subsidies paid by the Nazi Government at that time, all incentive to work, produce or trade had vanished. Stocks would obviously in time be worth more than the reichsmarks which they would realise, and were concealed to evade the orders of the occupation authorities that production and trading must be resumed. The result was a very limited amount of trading by barter, despite the somewhat illogical base in this form of trading.

It was not until the early summer of 1946 that the Control Commission took in hand seriously the task of bringing the German economy into operation again, but the most obvious of measures, the provision of a worthwhile currency, was delayed until June, 1948, largely by the long-drawn-out negotiations with the Russians to achieve agreement on a universal currency for Germany. Stocks of concentrates, scrap, ingot and semi-fabricated metals were immense, but lay idle from lack of incentive to trading.

The Metallurgical Industries (Non-ferrous) branch of the Control Commission was the first to form a German planning and control organisation with, as its first task, a census of stocks and workable capacity. This office came into operation in May, 1946, but, as was expected, great difficulty was experienced in extracting reliable information from stockholders. It gradually became clear, however, that copper, available in the form of concentrates, scrap, anodes, cathodes, wire bars, semi-fabricates, etc., amounted to at least 120,000 tons, lead to 90,000, zinc to 80,000, and aluminium to many thousands of tons, largely in the form of scrap. A great deal of "booty" aircraft and munitions scrap was released to the Germans by the occupation authorities, to make good the supposed dearth of metals, before the world shortage of metals to meet production for the "sellers' market" was appreciated. This was stopped in 1947.

But still nothing moved. Coal, and consequently electricity, gas and transport, was short, and labour was absent working in the black market or seeking food and other necessities of life. But, above all, there was no incentive to work because a few days of work would buy rations, such as they were, for a month and there was nothing else

On Other Pages

The annual subscription to THE CHEMICAL AGE is 30s.; single copies, 9d.; post paid, 1s. SCOTTISH OFFICE: 116 Hope Street, Glasgow (Central 3970). MIDLANDS OFFICE: Daimler House, Paradise Street, Birmingham Midland 0784-5). THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited

for the German people to buy.

The remedy for the state of affairs, when it had been diagnosed, was the grant of special incentives to coal miners and, under the Washington agreement of December, 1946, to pump raw materials imported at the expense of the Allied Nations into the supposedly empty pipe lines. The process began in the summer of 1947 and presented an opportunity of which the Germans took full advantage, using as arguments the difficulties of mining and smelting and the paucity of stocks.

In fact, by the end of 1947, they were demanding and obtaining imports of every non-ferrous metal, with the exception of magnesium, at the rate of $40 million a year. The production of aluminium and magnesium was forbidden by quadripartite decision at Potsdam. Stocks of bauxite amounted to nearly 300,000 tons.

The production of metals varied greatly from month to month, but the following may be taken as a reasonable average of the monthly figures in 1947: Electrolytic and refined copper, 2903 metric tons; lead, 2136 metric tons; raw zinc, 1777 metric tons; aluminium, nil.

With the advent of a worthwhile currency, goods and materials of all kinds appeared as if by magic, and produced a wave of buying and optimism, which ceased only when savings had gone and wages and salaries did not rise. The production of non-ferrous metals from indigenous sources and hoarded scrap increased steeply, including the primary production of aluminium which had been sanctioned early in 1948, until it amounted in March, 1948, to: Electrolytic and refined copper, 10,300 metric tons; lead, 8400; zinc, 7700; aluminium, 2900.

With the cessation of the wave of spending and the general shortage of money, demand fell greatly, and the above figures represent, with the exception of aluminium, a gross overproduction. The production of lead and zinc has now been restricted and Germany to-day is seeking to export 25,000 tons of lead (in addition to 15,000 tons exported in the past few months) and 12,000 tons of zinc. Copper has not so far been offered for export, but this may well occur unless means for freeing the monetary situation without destroying confidence in the currency are found. The production

(*continued on page 176*)

Notes and Comments

Defending Patent Rights

ONE of the indirect results of the trend of much post-war legislation—towards the creation of new conditions in industry and the professions—has been to confer new importance on the guardian duties of trade and kindred federations. The Patents and Designs Bill, now issued in the amended form, supplies one of the examples of this. The sweeping powers for the Government sought in the first draft of this Bill have undergone substantial modification in one or two important respects as a result of the joint intervention of the Federation of British Industries and the Trade Marks and Patents Federation in defence of originators and users of patents and patent agents. These modifications are of a kind to secure fair play for patentees and agents, thus rendering the Bill a much more practicable proposition. No legislation which unjustifiably deprives a useful section of the community of the prospect of fair reward can be good law or good for the country. Patentees can undoubtedly be classified in the useful category, notwithstanding the inclusion among them of a sprinkling of eccentrics, and the Bill as it stood would have left them with very much less incentive for investigation in any sphere in which the Government would be likely at some stage to take a proprietorial interest.

Government's Privileges

AMONG the more conspicuous aims of the Patents and Designs Bill is the prevention of restriction of use of new principles by proprietors who can be shown not to be making adequate use of them themselves. The controversial character of that clause, which the Controller of Patents is to have the uneasy task of administering, is self evident, and when account is taken of the likelihood that the need to expand exports will be a factor in deciding whether a patent should be compulsorily licensed to others the need for safeguards does not need underlining. Some were provided, but they would not have operated when a Government Department chose to share a formerly exclusive right. The intervention of the FBI and the patents organisation has done away with this unwarranted privilege for Government agencies, who are to be treated on the same footing as other "interested persons," and has also disposed of another fruitful source of discontent among investigators whose ideas have been taken up by the Government—the great difficulty of ascertaining what use, if any, was being made of them. Government departments will now have to give an account to the patentee—unless, of course, his process has the misfortune to belong to the growing category of matters about which nothing must be said, for reasons of security.

Need for Scientists

A RENEWED warning that the number of scientists in this country is still indequate to the industrial and Government needs is contained in the second annual report of the Advisory Council on Scientific Policy, of which Sir Henry Tizard is chairman. This undoubtedly well informed view of the progress towards closing the very wide gap between demand and the supply by the universities and technical colleges of scientific workers does not accept the slightly more optimistic estimates which have lately been mentioned, and it presents incidentally one of the few observations upon the well worn topic of industrial productivity here and elsewhere which have not grown stale with repetition. The greater productivity in the U.S.A. and the industrial prosperity of certain European countries lacking some of our natural advantages are due, the council suggests, to the fact that our competitors attach more importance than we do to supplying industry with

technologists of a university standard. There is little doubt that the acquirement of such qualifications, or something approaching them, is more widely sought in a good many countries than it is here and that the necessary training is more easily come by. Whether one accepts or discounts the advisory council's conclusion that the most efficient application of science is the prime condition for regaining prosperity here, the fact that the authority nearest to the Government is proving so consistent an advocate of scientific methods must confer real benefit in the long run on the rôle of science in the general economy. It is also capable, unfortunately, of heightening the Government's demands, in competition with industry, for such scientists as are available.

Impartial

ATTACKS on Government policy of tight control of industrial materials have been so widespread as scarcely to rank any longer as news. The theme, however, acquires an arresting new vitality when it is presented, as it was last week in the *Board of Trade Journal*, which is understandably not generally one of the critics of the principles of "planned economy." The spokesman in this instance was Sir John N. Barran in an address as chairman to shareholders of Barry & Staines Linoleum, Ltd. He told them (and the readers of the *Board of Trade Journal*):—

"Year after year, since 1945, I have emphasised the contrast between the strong and universal demand for our goods on the one hand, and the obstinate thickset hedge of Government delays, stintings and prohibitions through which we are still hewing our way. But that is not all. The prices at which inadequate supplies are still doled out have been until very recently, in the case of linseed oil, something like 70 per cent above the same oil in the free market . . . . Had control sought for the most effective way to hamper our task in making dollars they could not have found a better one. Those who make such demands on the industry must know, or if they do not they are unfitted for control, that what they ask is a sheer impossibility . . ."

The doubtful old journalistic axiom . . . "man bites dog" . . . seems at first sight to have found an arresting modern parallel—until it is observed that this column in the *Journal* is headed "Advertisement of Company Meeting." The impartiality which prompted acceptance of the advertisement deserves some applause.

Attracting Chemical Workers

THE problem of attracting workers to the heavy chemical plants and the lengths to which organisations such as Imperial Chemical Industries, Ltd., are prepared to go in order to stimulate recruitment are shown in one aspect of the company's £13 million scheme for expansion at Northwich, Cheshire. It is hoped to get 3000 Liverpool and Merseyside men to settle permanently in the district over the next three years, of whom 235 are required in the next six weeks, 120 by the middle of this month. The company is offering to married men between 20 and 30 a five-day week of 44 hours and a starting wage as labourers of £5 3s. 7d. More can be earned when they have graduated to shift work or to higher grades, and married men will get a special allowance of £1 4s. 6d. a week until their wives and families are transferred to Northwich. Perhaps the most powerful incentive that can be offered nowadays is the certainty of a good house and I.C.I. has evidently gone to a great deal of trouble to make that available. Of the 3000 new houses now being built at Northwich, 2500 will be reserved for I.C.I. workers.

GERMANY'S NON-FERROUS METALS

(*continued from page* 174)

of semi-fabricates other than of lead has fallen since March 1, 1949, and will not recover until the optimistically accumulated stocks can be liquidated in the home or export markets.

The *volte face* within twelve months is complete. From demands for imports to provide stocks to re-start industry, Germany is now trying to find export markets for her surplus production of two of the most important non-ferrous metals.

BRITISH CARBON BLACK

Scope of the Philblack Project

SOME amplification of the details of the programme by Philblack, Ltd., to manufacture carbon black at Avonmouth, employing the technical processes of the Phillips Petroleum Company, of Oklahoma, U.S.A., was given by the deputy-chairman, Lt.-Col. C. P. Dawnay, at the annual general meeting of the Philblack Company last week.

The plant, he said, was designed to have a productive capacity of 50 million lb. of carbon black per annum, and it was believed, it would be the largest of the carbon black plants now being built in England. Regarding the other carbon black projects undertaken in this country, the chairman observed that there are a number of different grades of carbon black required by the rubber industry, of which Philblack supplies only two.

Hitherto the U.S. had supplied virtually the whole world demand. It was estimated that the establishment of a home industry would result in a saving of $8 to $10 million a year. Philblack, Ltd., when in full production, could make a yearly saving to this country of $4 million. The company was acquiring the lease of a site near Avonmouth and its engineers formally took it over and commenced work there on May 6 this year.

In addition to the saving of dollars, which the production of carbon black in this country entailed, it was anticipated that a profitable export trade could be developed, particularly to Australia, where the market did not warrant the establishment of a domestic industry, but where the dollar shortage was as great as in this country.

Agricultural Use of Ash

SOME degree of success is said to have attended experiments carried out in Edinburgh by the corporation cleansing department to utilise fine screened ash as soil dressing. Low-lying ground has been built up with as much as 10 ft. of finely screened ash to grow root crops directly in it. The dry weather has slightly hampered this experiment this year, but hay was successfully grown 12 months ago and the previous year. A further development is to remove the top soil and then replace it after dumping the screened ash. Although it lacks fertilising constituents, the ash appears to be able to release such components in the ground.

LINSEED SUBSTITUTES

Promising Reports on Vegetable Oils

CLOSELY following the announcement that a group under Prof. T. P. Hilditch, at Liverpool University, had discovered a substitute for linseed oil (THE CHEMICAL AGE, *61*, 141), comes news of further important research in connection with sunflower seeds.

Oils obtained from niger seeds, safflower seed and sunflowers of suitable varieties grown in East Africa and Rhodesia, states the annual report of the Colonial Products Research Council, are of high linoleic acid content. It is expected that the oil from these seeds will equal or possibly surpass that of the soya bean in value to the paint industry. The U.S.A. is the greatest grower of soya beans.

While an oil with a high linoleic acid content is required by the paint industry, an oil with a lower unsaturated acid content is needed for conversion to edible oils of good palatable quality.

"I am working at present on investigations to show whether it is variety of seed, environment or soil which is the determining factor," said Prof. Hilditch last week. "It is fortunate that there is a greater tendency towards those with lower unsaturated acid content as there would naturally be a much greater demand for production as a foodstuff than for the paint industry," he added.

"The work, by the nature of it, will have to continue for a fairly long time before we get any results. Our long-term objective is to stimulate production of these oil-giving seeds primarily in the Commonwealth, or at any rate in the sterling area countries. We want to be rid of dependence on the Argentine and as independent as possible of the United States for these oils."

German Technology

FURTHER reports on German industrial technique are now available from H.M. Stationery Office. Among these are:—

BIOS 1490. German gypsum industry (British, American and French zones), (17s. 6d.).

BIOS 1867. An investigation into the steel bridge and constructional engineering industry of Germany, (11s.).

Classified lists No. 18 (1s.) and 19 (2d.) of all reports on German and Japanese industries published up to August 31, 1948, and technical indexes, parts 1 to 6, are also on sale.

American Coke and Chemicals

Total Output of By-Products Increased

PRODUCTION of coke in the U.S.A. in 1948 established a new record for the industry with a total of 74,861,928 net tons, the highest figure ever attained. This was 1,416,078 tons (about 2 per cent) more than in 1947 and 824,111 tons (1 per cent) more than the wartime peak reached in 1944.

Comparative figures of yield and value for the previous three years and also those of 1937 are given in the table below.

These figures, compiled by the U.S. Bureau of Mines, also reflect the production of the principal coal chemicals. These increased in 1948, although yields per ton of coal carbonised decreased because of the poor quality of the coal charged and the high rate of oven operation.

Tar production increased 2,580,626 gal. over 1947; ammonium sulphate or equivalent, 34,763,170 lb.; gas 23,590,346 cu. ft.; and crude light oil, 1,110,602 gal.

The total value of coke and breeze produced and coal-chemical materials sold in 1948 reached a new record of $1,230,234,113.

STATISTICAL TRENDS OF THE COKE INDUSTRY

	1937	1945	1946	1947	1948
Yield of coal-chemical materials per ton of coal charged:					
Tar ... ... gal.	8.67	7.95	7.82	7.78	7.60
Ammonium sulphate or equivalent ... lb.	21.84	20.22	19.79	19.66	19.52
Crude light oil ... ... gal.	2.86	2.84	2.77	2.75	2.73
Surplus gas sold or used ... ... cu. ft.	6.66	6.33	6.29	6.27	6.25
Average gross receipts for coal-chemical materials per ton of coke produced:					
Tar sold and used	$0.502	$0.447	$0.466	$0.605	$0.828
Ammonia and its compounds	$0.326	$0.356	$0.361	$0.423	$0.545
Crude light oil and its derivatives (including naphthalene)	$0.435	$0.503	$0.467	$0.566	$0.685
Surplus gas sold or used	$1.483	$1.413	$1.542	$1.678	$1.839
Total coal-chemical materials (including breeze)	$2.974	$3.069	$3.207	$3.710	$4.419

Expanded Scope of U.S. Chlorinated Benzene Industry

PRODUCTION has now begun at the new million dollar chlorinated benzene production plant of the Columbia chemical division of the Pittsburgh Plate Glass Co., at Natrium, West Virginia.

The plant, under construction for more than a year, adjoins a large chlorine and caustic soda producing equipment constructed during the early years of the war.

Production of the chlorinated benzenes marks the division's entry into the field of organic chemical compound production. Substantial quantities of chlorine will be consumed daily in the manufacturing method, which is somewhat similar to oil processing.

In the continuous chemical process, muriatic acid and monochlorbenzene are the first products. Hydrogen chloride is recovered as an anhydrous gas and then absorbed in water to produce muriatic acid of the desired strength. Monochlorbenzene in the process is separated by distillation. Para-dichlorbenzene and ortho-dichlorbenzene are recovered last and separated by distillation and crystallisation.

Among the applications of muriatic acid are the manufacture of pharmaceuticals, dyestuffs, pickling and cleaning metals, and textile dyeing. Monochlorbenzene is used as a solvent for paints, varnishes and lacquers, and in the production of insecticides, drugs and other organic chemicals.

Para-dichlorbenzene, a white crystalline material, will be produced in seven screen sizes for commercial use. It is used in a broad variety of agricultural and domestic insecticides, in the control of tree-destroying insects and deodorants. Ortho-dichlorbenzene is used as a solvent for resins, tars, gums and in the manufacture of dyestuffs.

POLLUTION OF SCOTTISH RIVERS

Possible Utilisation of Effluents

From A SCOTTISH CORRESPONDENT

SCOTTISH authorities are giving increasing attention to the causes of pollution of rivers, whether by industrial operation or by misuse of the waters for sewage disposal, and to means of prevention. Evidence currently available suggests that this position is again reaching a point where some decisive action may be forced.

The Scottish Salmon Angling Federation, meeting in Edinburgh, blamed County Councils for pollution, because of inefficient sewage disposal methods. This body is to press to have the matter ventilated and will bring home the point that local authorities are themselves largely responsible for the situation through refusal to spend money on sewage disposal.

The law on the subject was admitted to be most confused. At the same time, the Burgh of Musselburgh charged the Burghs of Bonnyrigg and Lasswade, and Dalkeith, of pollution of the Esk.

These and other complaints emphasise a new interest in pollution, and a determination to bring matters to a head is evident.

Industrial Responsibility

Industrial concerns realise that it is in their own interests that some definite action should be taken. The fact that so far they have not been predominantly to blame is no guarantee that they will have immunity in the future.

In view of the increasing costs of new materials, it has been suggested that it might be possible to reclaim more useful material from effluents. What was formerly useless waste and uneconomic to salvage may now prove of value.

Mr. David Murray, in Glasgow, has pointed to the fact that the Clyde is virtually an open sewer for chemicals from gas works, paper mills, collieries and chemical plants. The flow of the river is normally strong enough to offset some of the dangers of these waste effluents. The Kelvin is also an open sewer, for which paper mills are regarded as being chiefly responsible.

The need to develop a system of individual waste recovery, and effluent purification in the Clyde Valley was urged. Some such systems are already in existence and might be profitably adapted to the advantage of the firms concerned.

Other Scottish rivers are equally involved. There is evidence that even in the location of new factories, rivers have been regarded as legitimate means of disposal, even of such chemicals as cyanide used in electro-plating.

Spent Chemicals

It is being suggested now that the Directorate of Salvage and Recovery should investigate such disposal of spent chemicals to determine whether use could be made of them.

The intention is to tackle individual sources of material and to analyse their potential value in any other form.

Whether it would be economically feasible to salvage much more waste is less certain and a great deal of caution will be observed in advancing claims. It has been demonstrated, however, that in some instances effluent can be usefully converted.

This approach differs from that of the other bodies involved whose main attitude is based on the harm to the amenities.

Writing in the *Glasgow Herald*, a critic of the pollution of the Kelvin points out that recovery processes are already available and could be used if desired.

"Soda recovery plants operating at quite high efficiencies have been standard practice in the paper trade for many years. But pulp washing is one of the least studied processes in British mills, and it is with dilute black wash liquors that the trouble appears to lie," he points out. "These could be recovered at a cost either involving more fuel or the installation of counter-current rotary vacuum washers, so successful with wood, and adapted to the needs of esparto or straw.

Valuable Solvents

"Shortly before the outbreak of war in 1939 a scheme was put forward which would enable the papermaker to recover the soda used in his digesters and at the same time from the lignin bodies produce valuable solvents, motor spirits, and oils.

"Although sound technical advice predicted handsome over-all profits, the paper trade could not at that time be persuaded to put up the capital required to set a co-operative scheme going."

LEATHER CHEMISTS CONFER

Schedule for Next Month's Meeting

THE annual conference of the Society of Leather Trades' Chemists will be held on Friday and Saturday, September 16 and 17, at the University, Leeds.

The programme opens at 9.30 a.m. with a paper by P. Danby (leather industries department, Leeds University), on "The Chemistry of the Chamoising Process," and other speakers in the morning session will be R. G. Mitton (British Leather Manufacturers' Research Association), on "The Planning and Interpretation of Experiments on Variable Material such as Leather," and C. C. Posnett on "Leather Chemists—Control and Development."

The afternoon session will be devoted to the business meeting of the society, and committee reports, preceeded by an address on "Some Causes of Variation in the Composition of Fish Oils," by J. A. Lovern (DSIR, Food Investigation, Torry Research Station, Aberdeen).

On Saturday morning there will be two papers: "Some Physico-Chemical Aspects of Leather Dyeing," by W. Siddall (science department, Northampton College of Technology); and "The Manufacture of Hide Glue and Gelatine," by W. M. Ames.

VALUABLE COAL CHEMICALS

AN indication of the value of some of the various chemical and other by-products derived in association with the production of manufactured solid fuel was given by the chairman of Coalite and Chemical Products, Ltd., Commander Buist, at the annual meeting of the company in London last week. Evidencing the company's contribution to the reduction of dollar expenditure, he said it had sold last year 2 million gal. of motor fuel, £71,000 worth of liquid products for export and 9000 tons of mastic material, sufficient to provide substitute for soft-wood floors for 50,000 houses.

The chairman disclosed that two new sections of the refinery had been put to work during the last few weeks, and a third section would follow next month. Another addition to extract special and scarce phenols from effluent liquor, formerly run to waste, should be commissioned by the end of the financial year. These new sections would considerably increase refining flexibility and result in the introduction of new products.

"The intensity of research is being maintained," said Commander Buist.

STANDARDISATION

BSI Promotes Increased Output

AT the 48th annual general meeting of the British Standards Institution last week the president, Lord McGowan, referred to the greatly increased interest during the past year both by industry and Government in the extension of voluntary standardisation on a national basis.

The investigations by the committee for standardisation of engineering products under the chairmanship of Sir Ernest Lemon had substantiated the view, long held by British industry, that the principles on which the BSI works are effective and can be extended.

The Anglo-American Productivity Council had recently stressed the importance of standardisation and simplified practice, and Lord McGowan submitted that there was probably no more effective means for increasing productivity.

Another significant development during the past year had been the co-operation of the nationalised industries with the BSI and the increase in the collaboration among large industrial users with a view to assisting manufacturers to reduce the number of types and sizes.

This progressive standardisation would greatly assist the economy of the country by enabling manufacturers to introduce longer runs and better methods.

Mr. Roger Duncalfe, chairman of the institution, said that Government and industry have jointly agreed that industrial standardisation should be effected through the BSI and that "industry" included all the great professional institutions.

Sir William J. Larke, K.B.E., who has had a distinguished career in the steel industry, was elected as the new president of the institution.

New U.S. Emulsifier

A new emulsifier, S-1072, an amber coloured, viscous liquid which does not contain sulphonates, is being produced in the U.S.A. by the Glyco Products Co., Inc. It is readily soluble, cold, in orthodichlorbenzene and is therefore of interest for the manufacture of orthodichlorbenzene emulsion concentrates. The concentrate emulsifies rapidly, with little agitation, in water over a wide range of concentrations. A concentrate is made using 25-30 per cent, by volume, of the emulsifier and 70-75 per cent orthodichlorbenzene, 1 part of the concentrate is emulsified in 50-100 parts water.

Bases of the Fermentation Industries

Some Aspects of Fungal Metabolism

by J. H. BIRKINSHAW*

THE systematic investigation of the products of the micro-fungi was initiated by Wehmer who showed that oxalic and citric acid were major products of fermentation of *Aspergillus* and *Penicillium* species. The discovery of the production of citric acid laid the foundation for the fermentation citric acid industry which has nowadays become of considerable importance. Other acids of commercial value produced by the fungi are gluconic (*see page* 183 *this issue*) and itaconic acid.

These acids and a number of other simple acids of purely academic interest typify the oxidising capabilities of fungal metabolism. That the fungi are also capable of a reductive type of fermentation is shown by their production of ethyl alcohol, glycerol, and the sugar alcohols such as erythritol and mannitol.

A large number of other metabolic products of more complex structure are known, which illustrate the synthetic activities of the fungi. It is possible to select from these products certain groups which show interesting chemical relationships.

A brief review of some of the groups serves to indicate the type of pattern which is being formed by the few portions of the mosaic that have been pieced together. It is hoped that eventually these studies will throw considerable light on the mechanism of the fungal metabolic processes.

Common Denominator

The first groups to be reviewed are those on the acid citric, itaconic and succinic. The substances comprising these groups are elaborated in some cases by fungi, in other cases by lichens, which are symbionts of fungus and alga. The acids considered in these groups all show the characteristic of having long saturated carbon chains inserted as substituents in the molecule of the parent acid.

The next groups illustrated belong to the heterocyclic series but contain only carbon-oxygen rings. Examples of three, five and six membered rings are known. The tetronic acid series of fungal products forms an interesting family of closely related acids, showing only small differences in the substituents of the ring and having an obvious relationship with ascorbic acid and with penicillinic acid which has antibiotic properties.

In the aromatic series a number of phenols and phenolic acids are encountered of varying degrees of complexity. Some of these may be regarded as based on 2 : 4-dihydroxybenzoic acid, others are *p*-quinols and thus closely related to the benzoquinones, which are also found as metabolic products. It is considered probable that the quinols and their corresponding quinones, which frequently occur together, form an oxidation-reduction system which is closely concerned with respiratory processes.

Only one example of a naphthaquinone is known, but a number of hydroxyanthraquinones have been isolated from fungi. These are based on 2-methylanthraquinone and form a closely related series in which the position and number of the hydroxy-groups is the main variable. If we consider these anthraquinones as built up from phenols and phthalic acids, as in chemical synthesis, it is possible to visualise some of the simpler compounds, which occur as fungal metabolites, as possible precursors in biosynthesis.

The metabolic products so far considered contain only carbon, hydrogen and oxygen. Other common biological elements such as nitrogen, sulphur and chlorine enter into the composition of fungal products. Types of these are illustrated by the fungal antibiotics of known structure which are of proved high value in the field of chemotherapy and which are therefore of great importance in the medicinal chemical industry.

* These abstracts reproduce some of the topics discussed at last week's congress by the Royal Institute of Chemistry at St Andrews on industrial fermentation.

ALCOHOL FROM MOLASSES

by Dr. E. V. BELL*

DURING the period between the two wars, much scientific and technical progress has been made in the type and purity of the yeast used for molasses fermentation and in the fermentation plant employed. Specially selected strains of *Saccaromyces cerevisiae* capable of

tolerating high concentrations of alcohol and possessing stable and uniform characteristics are now employed.

Pure culture yeast plant suitable for growing yeast, uncontaminated with other organisms, up to a sufficiently large scale for seeding industrial alcohol fermentations has been developed. The yields of alcohol and the quality have correspondingly improved.

In recent years, advances in the fermentation of molasses for alcohol have been mainly along three lines:—

1. The development of continuous fermentation processes.
2. Methods for improving the medium prior to fermentation, and
3. The "re-use of yeast" process in which the yeast is recovered at the end of fermentation and used again for many subsequent fermentations.

In the continuous processes, sterile molasses solution may be fed to a fermenter containing a pure yeast culture already developed there, according to the method of Alzola. When full, the fermenting mash is made to flow through a number of fermenters in series, so that when the mash leaves the last vessel it is completely fermented. The feed of mash to the first fermenter is continued until the yeast in the system becomes infected and degenerates. The plant is then emptied, sterilised and re-stocked with a fresh yeast culture.

According to the method of Karsch, the entire quantity of yeast in the fermentation system is circulated through two fermentation vessels in series, being recovered by means of a centrifuge from the fermented mash leaving the system and entering the grist fermenter along with fresh mash to the fermented. Other continuous processes employ systems which include a tower or column down which the mash passes in contact with yeast.

During the fermentation of molasses for alcohol production, various infecting organisms may develop. The types usually encountered are those producing acids from sugar and alcohol, an infection producing acrolein from the by-product glycerine and organisms which reduce nitrates in the mash, causing contamination of the important by-product carbon dioxide with nitrous gases. It would appear that in operating continuous fermentation processes, greater precautions against the development of infection might have been taken than are necessary with the ordinary batch type of fermentation.

During recent years several novel methods of preparing molasses mashes for alcohol fermentation have been introduced. The molasses treatment process of Arroyo is combined with a special fermentation procedure.

The yeast re-use process of the Usines de Melle is based on the suppression of the consumption of sugar for yeast proliferation, once a sufficient quantity of yeast has been developed in the fermentation system. This saving in sugar is said to result in a corresponding increase in alcohol yield.

All the yeast present in the fermented mash is recovered by centrifuging and used for subsequent fermentations. Reproduction of new yeast cells takes place only to the extent necessary to replace the small proportion of cells which die in each fermentation.

ASEPTIC TECHNIQUE

by A. PARKER *

THE fundamental principles of aseptic technique in industrial fermentation were first recognised by Pasteur and his contemporaries, but these principles have been applied, in their fullest sense, only to industrial scale fermentations which have been developed in recent years.

Most fermentations practised hitherto have exhibited some selective action, favouring the micro-organisms whose culture is desired, and tending to suppress the growth of infecting micro-organisms. The aseptic techniques used for these fermentations have only supplemented this selective action to the extent of assuring the economic success of the processes.

Consequently, the ideal of making the fermentation plant and the atmosphere and materials used in the plant the exclusive preserve of the micro-organism being cultured has arisen only with the development of processes such as the manufacture of penicillin, where it is essential to combine all the principles of aseptic technique in a system which will guarantee that conditions of pure culture are maintained through all stages of fermentation.

This is necessary because many types of bacteria, which produce an enzyme, penicillinase, capable of destroying penicillin rapidly, grow readily along with the penicillin species being used, and cause serious loss of product if they are not excluded.

This ideal may be represented by the following principles which have guided the design and operation of plant for the manufacture of penicillin on the large-scale.

(*continued on page* 184)

Gluconic Acid in Industry

Useful Services to Tanning, Food and Metals

by A SPECIAL CORRESPONDENT

ONLY within the last few years has gluconic acid assumed importance as an industrial chemical. Today this monocarboxylic acid derived from glucose is finding application in the mineral tanning of hides and skins, textile dyeing, the acidising of oil wells, cleaning and pickling metals, cleaning milk cans and in the manufacture of various gluconates and also glucose delta lactone.

Gluconic acid is the first oxidation product of d-glucose and is usually prepared by a fermentative oxidation of glucose. In its pure state the acid is a fine white powder with a melting point of 131° C. and a specific rotation $(\alpha)_D$ — 6.7 deg. It decomposes at 180° C.

The commercial form of gluconic acid is usually a 50 per cent aqueous solution, a light yellow syrupy liquid having a specific gravity of 1.24 and possessing a very slight odour and a mildly acid taste. Although it is liquid at room temperature, the solution tends to solidfy when exposed to cold weather. In aqueous solution, gluconic acid is partially transformed into an equilibrium mixture with the gamma and delta lactones, both of which are inner anhydrides formed by the elimination of water within the molecule; the actual neutralisation value, however, of an aqueous solution behaves as if it contained pure gluconic acid.

Stabiliser

Gluconic acid forms soluble metal salts, and, what is of great interest, the presence of gluconic acid, or certain of the gluconate salts, tends to hold many metallic ions in solution even when alkaline. For many applications where it is necessary to adjust the *p*H value of soluble metallic salts by the addition of alkali, the presence of gluconic acid prevents precipitation. The following industrial applications now utilise these unique properties:—

(1) In mineral tanning using aluminium sulphate or potash alum, it is necessary to increase the *p*H value towards the end of the tanning operation by the addition of sodium bicarbonate or soda ash. The presence of gluconic acid in the tanning bath prevents precipitation and also tends to improve the quality of the leather. Claims are made that aluminium gluconate gives a more durable leather than ordinary aluminium sulphate, moreover, it increases the absorption of dyes by the mineral tanned leather.

(2) In the acidising of oil wells difficulty is often encountered due to the precipitation of iron as the acid is neutralised by the limestone. This precipitate prevents the desired flow of crude oil and defeats the object of adding acid. By adding gluconic acid to the acid, precipitation is entirely avoided.

(3) The addition of gluconic acid to electro-pickling and metal cleaning baths is claimed to give certain substantial benefits, such as longer active tub life, low acid consumptions and rapid pickling action.

(4) In metal plating this organic acid permits adjustments to the optimum *p*H without risk of precipitation.

(5) The cleaning of milk cans with ordinary commercial cleaners of an acidic type is liable to have a marked corrosive effect on the metal. To overcome the danger of corrosion the addition of gluconic acid is recommended. It possesses a low corrosion rate and also assists in the removal of dirt and of any alkaline film which might provide a medium for the action of bacteria.

In addition to the use of gluconic acid for processes where it can prevent the precipitation of metals from solutions, this acid is also claimed to be of value in textile dyeing. According to dyeing experts in the U.S.A., the use of gluconic acid improves the penetration of direct colours and ensures more even results, at the same time, there is no weakening of the fibre, a risk which is always present when strong mineral acids are employed.

The two most important gluconates are sodium gluconate and calcium gluconate. The first is a white crystalline product produced by neutralising gluconic acid with sodium carbonate or hydroxide. It is very soluble in water.

Like gluconic acid, this salt prevents the amphoteric metals, aluminium, iron, chromium, tin, and titanium, from being precipitated upon neutralisation of acidic solutions containing them. It is useful, therefore, in the plating of metals, tan-

ning of leather and the mordanting of fabrics and weighting of silks.

Recent developments in photography have shown that sodium gluconate is a useful ingredient of certain photographic developers containing metallic salts.

Calcium gluconate has so far found its chief applications in the food and pharmaceutical industries where it is highly esteemed as a soluble form of calcium. Although it has been suggested as a retarder to the setting of plaster, cement, and similar products, no worthwhile commercial use has yet been found for it in this field.

Glucono delta lactone is a white crystalline powder with a melting point of 153° C. and a specific rotation $(\alpha)_D$ 61.7°. It is formed by the removal of the elements of water from the gluconic acid molecule. Although not an acid itself, the lactone is partially hydrolysed in water into gluconic acid. So far, gluconic delta lactone finds its major use in the food and pharmaceutical industries, where its acid properties are the source of its usefulness.

BASES OF FERMENTATION INDUSTRIES

(*continued from page* 182)

1. The technique used for the preparation of starter cultures in the laboratory must ensure completely the exclusion of all contaminants.

2. The fermentation plant must be so constructed that all parts of it can be sterilised and that it encloses the culture from contact with outside contamination.

3. The air supplied to the plant cultures must be sterile.

4. The operation of the plant must be specified in such detail that relatively unskilled personnel can perform this in strict accordance with the simple sequence of actions laid down.

5. Every stage of the system of culture must be carefully checked by examination of samples for the presence of living micro-organisms other than the culture.

The way in which these principles have been applied in developing the techniques used for the manufacture of penicillin is illustrated by examples selected from the process. Methods are described by which the enclosed transfer of cultures from test tube to the final stage of the fermentation is undertaken, so that the chances of airborne and other contamination are virtually eliminated.

It is considered that the methods of aseptic technique developed for penicillin closely approach the ideal pure culture system, but it remains to be seen whether these methods are adequate for new processes yet to be developed.

SWEDISH ANALYSIS

Estimation of Fatty and Resin Acids

FATTY and resin acids have very different esterification rates and it is therefore possible to separate them analytically. Most of the analytical methods in present use are founded on this circumstance. As none of the reaction products formed is removed, a part of the fatty acids remains unesterified. Hence the results obtained generally lack a satisfactory accuracy, states Mr. Viktor Persson in an article, the full text of which appears in Swedish in the last issue of *Svensk Pappers Tidning*.

By means of carrying out the esterification with a mixture of n-butanol and benzene it was possible to separate in a simple way the water formed and a complete conversion of the fatty acids was obtained. At the same time, however, partial esterification of the resin acids takes place. In order to reduce this as far as possible, the catalyst is used in low concentration and the temperature kept down during the treatment.

Benzene sulphonic acid turned out to be a suitable catalyst, as it is not affected by the reaction. The concentration of the catalyst being constant, a definite amount of resin acids is esterified pro time unit. Thus it is possible to introduce an exact correction for the fraction of resin acids converted during the cooking.

Sulphuric acid, on the other hand, reacts with the rest of the reaction components, and its concentration decreases successively. In order to obtain accurate values, the esterification is carried out with an oil bath, the temperature of which must not be too high.

A great number of control tests on mixtures of known composition showed the new method to give good reproducibility. Determinations according to the method as stated by CCA 15 now usually applied in Sweden, on the other hand, give too high resin contents and larger differences between double tests.

Determinations of unesterified resin acids in the reaction mixture were made titrimetrically, but in case of resin acids with varying molecular weights gravimetric methods should be applied.

Coal in Nepal

Large deposits of high-grade coal are reported to have been discovered in the Terai Valley, on the Himalayan ranges of Nepal.

SYNTHETIC SUBSTITUTE FOR PALM OIL

U.S. Innovation May Aid Tinplate Production

From OUR NEW YORK CORRESPONDENT

A TEAM of U.S. scientists, comprising W. R. Johnson, research metallurgist, L. C. Kinney, supervisor of chemical engineering, and John M. Parks, supervisor of non-ferrous metallurgy, working at the Armour Research Foundation, Chicago, Illinois, are credited with having developed a synthetic substitute for African and East Indian palm oil, a vital necessity in the making of hot-dip tinplate.

Palm oil is used to provide a bath under which the tin solidifies smoothly and without excessive impurities on the surface of the steel. Some 7500 tons of such oil are used each year in the U.S.A. for this end. The present research was supported by the American Iron and Steel Institute.

Over a period of years, the price of the oil has fluctuated widely, rising from 8 cents per lb. before the war to a wartime peak of 40 cents. Moreover, all this oil is now imported from North Africa and the East Indies over long shipping routes, and the U.S.A. is in a strategically unfavourable position in an emergency.

Common Vegetable Oils

According to the three Chicago scientists, dimerised linoleic acid (dimer acid) was selected from a large number of possible substitutes for palm oil as having the best possibilities.

The dimerised acid, separated by distillation, consists of two linked molecules of linoleic acid. It is almost entirely free fatty acid. By virtue of its molecular structure, the material has a high flash point—600° F. as compared to about 470° F. for palm oil—and a volatility about one-third that of the African product.

In making hot-dipped tinplate, sheets of pickled steel are passed through a flux into a bath of molten tin and through an 18-in. layer of hot (450° F.) palm oil. Three sets of rolls, operating in the oil, smooth and thin the tin coating. In seeking a suitable substitute for the natural product, the scientists were faced with a formidable list of requirements. For an oil to function properly in a tin pot, it must conform to at least the following characteristics:

It should make smooth, bright, good quality tinplate; drain rapidly and freely from the sheet; possess low volatility and high flash and fire points; neither oxidise nor polymerise readily; clean readily from the sheet; and be of low viscosity at 100° to 200° F. so that it may be pumped or poured readily.

A thin oil layer, if allowed to remain on the sheet, affects the final employment of the sheet. The oil has to be non-toxic, odour-free, and preferably edible; should not become rancid during storage; or interfere with lithographing, lacquering, or soldering procedures and should retard atmospheric corrosion.

British Experience Consulted

The final selection of dimerised linoleic acid was made only after extensive basic research on tinning oil action, including study of British information on the subject and the work of the British Tin Research Institute. A mill test on this material, made in a Jones and Laughlin Steel Corporation plant, was encouraging, although the dimer acid tended to increase in viscosity.

Subsequent work was devoted to a study of dimerised acid base materials, and because the acid made a good showing in the mill test, three general lines of approach to further work were followed:

Correction of undesirable viscosity characteristics of dimer acid by the use of addition agents to improve low temperature viscosity and to retard heat-bodying;

Examination of various esterified dimer acid products which are known to have satisfactory low temperature viscosity characteristics and which give promise of good resistance to heat-bodying;

Examination of certain little known materials such as Mexican jojoba oil, which on the basis of the known composition should have highly desirable properties.

The successful laboratory results thus far achieved are expected to have wide economic importance for the steel industry. The scientists believe that there is a good possibility of finding a synthetic tinning oil which will be superior to palm oil in strategic availability, performance, and cost, although such an oil may require some modification in tinning procedures and equipment.

WEATHERING OF PLASTICS

Tests Simulate Service Conditions

WITH the increasing use of laminated plastics in aircraft during the past few years, especially in accessories and semi-structural parts, the need has developed for more comprehensive information regarding the action of the weather, temperature, and humidity on the properties of these materials.

Accordingly, the U.S. National Bureau of Standards, under the sponsorship of the National Advisory Committee for Aeronautics, undertook an investigation to determine the effects of outdoor weathering, accelerated weathering, and accelerated service conditions on the weight, dimensions, and flexural properties of representative phenolic and unsaturated-polyester plastics. The test materials were commercial products, and included nine laminated plastics and a macerated-fabric-filled phenolic plastic, types commonly employed in aircraft.

Strength Increased

In most of the tests the changes in weight and superficial dimensions were negative, any positive changes being in thickness. The flexural tests revealed several cases in which increases in flexural strength resulted from the accelerated weathering and service conditions. These increases in strength were attributed to further cure of the resins. The tests were of several kinds and included one year and two years' natural exposure, and accelerated weathering by ultra-violet light (120-480 hours) and temperature cycles (70°-175°F.).

Results of the laboratory ageing tests did not in all cases correlate with the results of outdoor weathering. A laboratory evaluation procedure for a material or group of materials must therefore be selected on the basis of the materials, the properties to be determined, and the conditions which the materials will meet in service, the bureau reports.

In an accelerated service test all the materials except the asbestos-fabric phenolic laminate increased in thickness. This material was also the only one which increased in flexural strength and flexural modulus of elasticity.

The asbestos-fabric phenolic and glass-fabric unsaturated-polyester laminates were the most resistant of the materials tested. The paper-base phenolic laminates were not so stable in weight and thickness after outdoor weathering.

WELDING CONTROL

Preventing Tip Pick-up

DESIGNED to provide a gradual increase in welding current at the beginning of the weld, a new slope control for use as an accessory with either synchronous or non-synchronous resistance machines which materially reduces tip pick-up in spot welding aluminium, magnesium, and their various alloys, has just been reported in the U.S.A.

The new accessory is intended for mounting in the side of synchronous controls, or can be supplied in a separate enclosure for use with older types and non-synchronous control.

The operator's panel consists of two dials and a transfer switch. The setting of one dial, which is graduated from 3 to 13 cycles in one-cycle steps, determines the time for the welding current to reach a final value from its initially low one. The other dial, graduated in per cent of the final current, permits adjustment of the initial value of the welding current. The transfer switch facilitates disconnecting the slope control for those operations for which it is not needed.

Laboratory tests made by the General Electric Company's control division are claimed to have resulted in obtaining 20 times as many spot welds on .064-in. 24 ST Alclad aluminium, before sticking occurred, as were obtained without the control.

POLYMER CORPORATION

CAPITAL expenditure totalling $2.25 million is provided for in the 1949 budget of the Polymer Corporation, Crown-owned company, it is disclosed following the annual meeting of the board of directors, at Sarnia, Ontario, Canada. The principal item will be $1.1 million for ethane cracking furnaces, designed to double the corporation's output of ethylene and provide for increased sales to Dow Chemical of Canada, Ltd. Greater production will also enable the polymer Corporation to raise its own output of styrene.

As a result of the co-operative arrangement, certain ethane cracking furnaces, surplus to Dow's operations at Freeport, Texas, U.S.A., were made available to Polymer. This put forward by several months the date when increased supplies of ethylene would be available. Erection of the ethane cracking furnaces is already well advanced at the Polymer Corporation's plant.

Metallurgical Section

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MINING AND METALLURGY

The Economical Uses of Ores and By-Products

THE Fourth Empire Mining and Metallurgical Congress, which took place from July 9 to 23 in London, with technical sessions at Oxford and excursions around Cardiff, Cornwall, Edinburgh and Newcastle-upon-Tyne, was in every way a great success. It gave all concerned with these industries and with the development of the mineral resources of the Commonwealth an opportunity to discuss all related problems and progress. The technical papers and lectures—more than 40—were presented in the following nine sessions: Mineral resources; modern methods of prospecting, some physiological and psychological effects on workers, petroleum, coal, present-day trends in mineral dressing, metallurgy and metallurgical industries.

The following notes give extracts of a characteristic selection from the twelve papers on metallurgical industries:—

W. B. Boggs dealt with some modern developments in copper pyrometallurgy. He gave elaborate details of the chief types of furnaces now used, stressing that electricity is destined to play a very important part in the future of copper metallurgy. Dealing with roasting, converters, cathode refining furnaces and reverberatory furnaces, the paper concluded with the importance of using the proper fuels and refractories so that with various altering furnace designs an increased tonnage is smelted with diminished fuel consumption.

Last Zinc Smelters

S. W. K. Morgan outlined the development and present-day operation of the two zinc smelting plants at Avonmouth and Swansea. These are now the only representatives in this country of a once extensive industry. It is argued that the fact that they have survived is due to a readiness to adopt the most economical methods of production, coupled with attempts to make full use of every value in the incoming ore. No English ores are available and consequently all of the 170,000 tons of concentrates required annually must be imported, and bought in competion with smelters abroad. He described the new methods which the home industry has adopted for the sintering and distillation process and for the production of high purity zinc. The electrolytic zinc industry was discussed in a paper by Harry Hey, Australia.

Waste Sulphur Gases

W. S. Kirkpatrick, Canada, described the economic utilisation of waste gases by the integration of base metal and chemical fertiliser operations at Trail, B.C. Necessitated by an atmospheric pollution problem, chemical plants were constructed to deal with the waste sulphur gases from the metal-producing plants in a manner that would not add to the cost of producing metal. Actually only one of the integrations is essential—namely, the recovery of sulphur dioxide from the metallurgical plant roaster gates. All other integrations, although secondary to the principal objective, have become important to the overall operation resulting in economic gains and in some cases disposing of nuisance wastes. They have reduced or completely abolished the importance of some raw materials and have increased the efficiency and recoveries of the operations. In some cases the chief advantage has been in the increase in the capacity of equipment, thereby reducing the capital charges. These developments give support to the contention that the integration of base-metal mining and metallurgical operations with chemical fertiliser production is technically an attractive proposition.

Major C. J. P. Ball presented a paper on extraction, alloying and fabrication of magnesium. Given comparative cost of power and raw materials, the electrolytic process operated by Magnesium Electron, Ltd., can compete with United States costs, and since all the raw materials required are available in Britain, this country can produce the whole of its mag-

nesium metal requirements if it so desires. New alloys have been developed, the improved properties of which are opening up fresh fields of usage. It has been demonstrated in practice that these alloys can be fabricated satisfactorily on steel equipment at steel speeds. It is probable that the greatly improved workability of the new zirconium-containing alloys will enable fabricating costs to be reduced so materially as to make their use more generally attractive.

Sir William Griffiths, D.Sc., gave a forecast of the nickel industry twenty years on, with reference to the by-products of nickel production. The nickel-sulphide ores of Canada have become one of the largest sources of copper in the Empire, while they are possibly the largest single source of platinum metals in the world. They provide significant quantities of gold and silver and make a useful contribution to the world's supply of cobalt. Selenium and tellurium are extracted from them, and, if present developments in the flash smelting of nickel and copper concentrates with oxygen confirm early promise, they will form an important source of liquid sulphur dioxide as well as sulphuric acid. As for nickel itself, the past twenty years have confirmed its position as one of the most useful metals available and as a prominent factor in making possible civilised life as known to-day, and during this time the world's peacetime demand has more than doubled. To meet this demand ores of lower and lower metal content have had to be utilised. The metal obtained from each ton of ore mined in 1948 was only 27 lb., as compared with 43 lb. of nickel per ton of ore in 1938.

Coinciding with the congress was an exhibition of underground machinery at Earls Court, showing a comprehensive collection of coal cutters, conveyers, power loaders, electric and compressed air drilling machines, pneumatic picks, electric equipment and a variety of accessories, of which many exhibits were running under power. The Institution of Mining and Metallurgy held in connection with the Congress a Symposium on the Refining of Non-Ferrous Metals, introduced with a lecture by Dr. C. H. Desch, F.R.S., on the effect of impurities on the properties of metals, while 19 papers dealt with the refining of non-ferrous metals.

Canada's Chemical and Metal Totals

THE upward trend in production by Canada's chemical industries was maintained in 1948 when the value (exclusive of shell-filling) reached a record total of $554 million.

The advance of $104 million over the 1947 figures, revealed by the preliminary report of the Dominion Bureau of Statistics, shows an apparent increase of 23 per cent. More than half this gain, however, was due to a change in statistical procedure, which included the vegetable oils industry among the chemical activities.

Higher output values were recorded for all industries, the percentage increases over 1947 being: Heavy chemicals, 20.6; fertilisers, 7.1; paints, 15.5; soaps, 18.2; coal tar distillation, 3.1; toilet preparations, 10.1; compressed gases, 14.8; medicinals, 0.3; polishes, 17.5; inks, 12.8; adhesives, 26.1; primary plastics, 21.5; and miscellaneous, 6.0. The vegetable oils industry gained 37.0 per cent.

Imports of chemicals and allied products in 1948 were the highest on record at $118 million, an increase of nearly 5 per cent over the previous year's total. About 90 per cent of the imports were from the United States and nearly 6 per cent from Britain.

The value of exports in 1948 was $79.8 million, a decline of about 5 per cent from 1947. Fertilisers accounted for $36.4 million, acids $5.7 million, sodium compounds $4.8 million, synthetic resins $5.2 million, calcium compounds $2.8 million, paints and pigments $6.2 million and medicinal preparations $3.1 million.

Growing Output of Base Metals

Output of metals in Canada in May this year showed a general increase, excepting nickel, which was sightly lower than in the same month of 1948, according to the Dominion Bureau of Statistics.

Production of new primary copper rose to 21,700 tons (20,700), while the total for the first five months of the year was 108,400 tons (102,300 in 1948).

May output of primary silver was 1,355,100 fine ounces, as against 1,125,600 in April and 1,072,700 in May, 1948.

Production of primary lead advanced to 17,800 tons compared with 11,300 in April and 12,700 in May last year, the cumulative total being 60,300 tons (62,100).

Production of primary zinc reached 24,800 tons, compared with 17,300 in April and 20,500 in May, 1948. For the five months output was 107,600 tons (93,300).

PHYSICAL CHEMISTRY OF IRON AND STEEL

Likely Source of Important Technical Gains

AMONG the papers presented before the recent Fourth Empire Mining and Metallurgical Congress was an important contribution by Sir Charles Goodeve, F.R.S., on "Future Trends in the British Iron and Steel Industry." In this, Sir Charles made brief reference to the researches into the physical chemistry of the steelmaking process.

The physical chemist apparently is still catching up on the art of making iron and steel, but the impact of physical chemistry in all aspects of iron and steel manufacture is likely to become substantial

In recent years there has been a great increase in knowledge of the thermodynamics of solutions of both useful and deleterious elements in liquid and solid iron. This knowledge includes the mutual effect of one solute on another, and is fundamental to the chemistry of refining, of solidification and of the formation of inclusions. It will certainly lead to ingots and sections which are purer, more consistent and better structure.

Progress in London and Glasgow

Rather more information about these researches is available in the recently published Annual Report of Council of BISRA for 1948. The chemistry department reports work undertaken by members of its Physical Chemistry Section working at Battersea, Imperial College and the Royal Technical College, Glasgow.

At Battersea, kinetic studies are continuing of the hydrogen reduction of ferrous oxide and magnetite produced by oxidation of pure iron under controlled conditions. Measurements have been made at temperatures from 900° to 200° C. and the observed overall temperature coefficient for the reduction rate is small. Initial induction periods have been obtained with FeO below about 680° C., but not with Fe_3O_4.

The conditions for movement, and the rates of movement of sulphur, between CO and CO_2 gas mixtures containing this element, and liquid iron protected by basic slags, are being investigated. The object is to determine whether considerable losses of sulphur to the furnace gases can possibly exist in the open hearth furnaces.

At Imperial College, the effect of carbon on the behaviour of sulphur has been measured, and the results published. It is very interesting to note that saturation of liquid iron with carbon halves the capacity of the metal for dissolving sulphur. The effect of high sulphur contents on the capacity to take up carbon is now under investigation.

Other thermodynamic investigations which are being pursued include the study of silicon in liquid iron, oxygen in solid iron and the conversion of oxide to sulphides. Attempts to solve the important problem of hydrogen in steel include measurement of the thermodynamics and kinetics of the absorption of hydrogen on solid iron with a view to determining under what conditions surface processes become rate controlling in the movement of hydrogen across the iron interface.

A method for the determination of dissolved oxygen by hydrogen reduction has been successfully developed and an apparatus for the determination of total oxygen by vacuum fusion is now being constructed. A rotating hearth furnace for deoxidation experiments is also under construction.

There is no doubt that, under the wise direction of Sir Charles Goodeve, the association is capable of making possible in the steel industry some most important advances in efficiency as more and more of these researches reach the stage of full application.

Electronics Exhibition

THE many and diverse applications of electronics were well illustrated at the fourth annual exhibition of the North-West section of the Institution of Electronics held at the College of Technology, Manchester, recently.

Among the variety of exhibits of interest to science and industry were devices for counting, recording, and controlling the temperature of furnaces and the speed of machines. Instruments for detecting gas in mines and metal in wood, and for measuring moisture content, pressure, viscosity, and thickness of paint are included in the range.

Two of the latest types of electron microscope and an electroencephalograph were also demonstrated.

Non-Ferrous Metal Statistics

Rising Stocks of Copper, Zinc and Lead

THE figures of production, consumption, and stocks of non-ferrous metals in the United Kingdom in June, supplied by the British Bureau of Non-Ferrous Metal Statistics, an abstract from which is published below, reveal a general increase in stocks. Closing stocks of blister copper were 578 tons more than at the end of May; those of refined copper increased by 8956 tons; unwrought zinc in concentrates by 3186 tons; slab zinc (all grades) by 14,648 tons; imported virgin lead by 12,454 tons; English refined lead by 534 tons; tin metal by 919 tons.

	Long Tons	
	Blister Copper	Refined Copper
OPENING STOCKS :		
Govt. and consumers'	38,209	79,282
Imports	9,752	17,557
PRODUCTION :		
Primary	—	10,562
Secondary	3,280*	5,560
CONSUMPTION :	10,670	27,404
Secondary	—	13,806
Exports	4,421†	3
CLOSING STOCKS :		
Govt. and consumers' ...	38,787	88,238

* Rough copper.

† Includes 3,252 tons rough copper dispatched to Belgium and 1,157 tons rough copper to Germany for refining on toll.

GROSS OUTPUT OF MAIN COPPER, ALLOY AND PRODUCTS

Unalloyed copper products	26,498 long tons
Alloyed copper products	20,652 " "
Copper sulphate	3,548 " "

UNWROUGHT ZINC

	Long Tons	
	Zinc in Concentrates (estimated gross Zinc content)	Slab Zinc (all grades)
OPENING STOCKS :		
Govt. and consumers'	10,655	60,741
Imports	10,203	16,524
PRODUCTION :		
Virgin and remelted ...	—	5,871
CONSUMPTION :		
Virgin (incl. debased)	7,017	13,645
Remelted and scrap ...	—	7,864*
Exports	—	20
CLOSING STOCKS :		
Govt. and consumers'	13,841	75,389

* Includes small quantity of zinc in concentrates consumed directly for chemicals, etc.

LEAD

	Long Tons			
	Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of secondary Scrap and Residues
OPENING STOCKS : Other than Govt. and consumers'	48	43,160*	4,156*	—
IMPORTS	4	19,807	—	168
PRODUCTION : ...	198	—	2,777	—
CONSUMPTION : ...	199	9,269	4,681	13,346
Exports ...	—	72	—	—
CLOSING STOCKS : Other than Govt. and consumers'	51	55,614*	4,034*	—

TIN METAL

	Long Tons
GOVT. AND CONSUMERS' STOCKS (at end of period)	15,762
IMPORTS	5
PRODUCTION	2,776
CONSUMPTION	1,797
EXPORTS AND RE-EXPORTS	271

ANTIMONY

	Long Tons
TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	366
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	199

CADMIUM

	Long Tons
TOTAL CONSUMPTION OF CADMIUM	32.50

Reviving Prospects of S. Rhodesian Platinum

RENEWED interest is reported as being displayed in the platinum deposits of Southern Rhodesia. Of nearly 80 blocks of claims registered recently in the Bulawayo district, nearly half were in respect of platinum deposits in the Belingwe area.

From time to time Rhodesia's platinum deposits have attracted considerable attention in the past, it is stated in a recent issue of *South Africa*, and investigations have been carried out in an attempt to overcome technical difficulties in the extraction of the metal and in relation to marketing it. In 1932, new discoveries concerned with the extraction of platinum renewed hopes, which had been dashed during the "boom" in 1920, for mining deposits and investigations in the Belingwe area attracted widespread interest.

The potentialities of the Belingwe deposits were thought by some to be worth some £40 million. Selukwe deposits, were estimated at double this figure.

It was estimated that the working costs then would not exceed 9s. 6d. a ton, and it was believed that Rhodesia could challenge Russia's supremacy as the world's producer of platinum. The method of extraction, however, apparently proved too expensive. Platinum is valued at about £19s. 10s. an ounce.

HARD CHROMIUM PLATING

Electrolytic Deposits on Light Alloys

by J. I. CORDWELL

HARD chromium plating, comprising a treatment of surface hardening which up to now has been employed on a wide range of steel components in recognition of the property which it confers of greatly increasing the useful working life, has had its field of application much extended during the last few years to the processing of light alloys. It has served to overcome many problems associated with the use of parts made in the light alloys, where lightness is an essential feature but where a harder surface than the alloy itself can afford is also necessary.

As hard chromium plating differs principally from ordinary chromium plating—termed decorative chromium—by the thicker coating of the electro-deposited chromium—this being of the order of 20μ to 0.1 mm. in the case of hard chromium and of the order of a few μ in the case of ordinary decorative chromium—direct technical interest attaches to the application of a thick chrome coating to the surface of components of aluminium alloy which have been previously nickel plated in an ordinary chromium plating bath.

A Satisfactory Base

The nickel deposits seemed in actual practice to be sufficiently hard for the provision of a satisfactory base for the chromium layer, capable of standing up to fairly severe treatment. In recent tests it was confirmed that the deposit of chromium on nickel flaked off even in the plating bath, and this happened whatever the type of surface preparation utilised, whenever the coating exceeded a certain thickness in the neighbourhood of 10μ. This phenomenon was due apparently to very strong internal tensions.

To follow this up, frictional tests were conducted on some trial pieces chromium plated in this manner, on which the thickness of the chromium plate approached closely to the limiting value. These tests demonstrated that, with good surface preparation, very adherent coatings could be obtained, which did not flake off during the wear test but wore away progressively.

Unfortunately, however, the resistance of the coating to rubbing and wear was still considered to be too low and did not give satisfaction as regards the object of the research. As a consequence, it was found necessary to develop a fresh process of hard chromium plating, permitting of obtaining on aluminium thick deposits of chromium ($e > 10\mu$), very adherent and possessing also a particularly high degree of hardness.

Nickel plating before applying the chromium deposit was found not to be necessary and, other deposits capable of adhering to aluminium components such as zinc, copper, etc., being too soft to support thick layers of chromium, it was decided to try to deposit the chromium directly on the aluminium without an intermediate undercoat.

Surface Preparation

The whole problem consequently resolved itself into finding a satisfactory type of surface preparation, capable of eliminating the natural layer of oxide which prevents the satisfactory adherence of the chromium deposit and at the same time to create a surface in relief favourable to the mechanical adherence of the chromium deposit.

Among the various methods proposed in the technical literature to resolve this general problem of the adherence of electrolytic deposits on the light alloys, the most promising ones appear to be those which comprise the employment of solutions of chemical stripping agents, by immersion of the light metal pieces in acid baths (HCl and HF) which can also contain a heavy metal salt (Ni, Mn). These methods are, in practice, the most simple to employ and permit the best results from the industrial point of view in the domain of electrolytic chromium deposition direct on the light alloys.

Acid Immersion Solution

Tests have shown that in the case of direct chromium plating an acid immersion solution can give good results, provided always that it has the power of exerting on the surface of the object a marked corrosive action, without being in this respect too aggressive.

On the other hand, no chemical cleaning bath can serve indiscriminately for all and every one of the light alloys. Indeed, a solution which is capable of giving excellent results for a given alloy is not

capable of being applied at all to the same alloy whose structure has been modified, for example by thermal treatment.

In general, so that a cleaning bath should be capable of giving satisfaction, it is necessary that the structure of the base metal permits of a fine and regular attack on the surface, so that there are formed, during the cleaning process, numerous superficial cavities in which the electro-deposited chromium can key itself mechanically. The nature of the cleaning solution to be used will be accordingly determined by the composition and structure of the alloy that it is desired to chromium plate.

Electrolytic Couples

To favour the formation of this etched structure, proper to the keying of the deposit, it has been found necessary in every case to add to the acid bath a salt of a heavy metal, which allows the corrosive action of the acids employed to manifest itself energetically as a consequence of the formation during the cleaning of a multitude of electrolytic couples, developed by the presence of this heavy metal in the bath.

After cleaning, the surface of the metal treated is covered with a deposit more or less adherent of the metal addition contained in the bath, which it is absolutely necessary to eliminate before the chromium plating stage. This is necessary to ensure that the electrolytic deposit of chromium will be adhering strongly to the support metal in the final stage.

It will be readily conceived that the deposition can only be favourably effected on a base more or less clean. The chemical treatment utilised for this effect, in certain cases, will not be able to dissolve completely the deposit obtained by chemical displacement, but it will be found that the adherence of the chromium coating does not suffer from this.

Keying the Plating

It may be added here, that from the test results it would appear that the particles of the chemical deposit, which, after the chemical cleaning stage, remain adhering on certain alloys, in the cavities created by the etching, participate in the mechanism of the keying of the electro-deposited chromium.

Below are given details, from the practical aspect, of the method of employment and the field of utilisation of these two types of cleaning solutions which have been studied in detail and have permitted of the obtaining of good results.

The first solution is composed of nickel chloride, hydrofluoric acid, and boric acid. The quantitative composition is: $NiCl_2$ 400 gm./litre; hydrofluoric acid 2 per cent; boric acid 4 per cent.

The components leaving the degreasing bath, after a rapid rinse, are immersed in the solution heated to 25°-30° C. until the gaseous emission caused by the attack of the bath on the light alloy diminishes in intensity. The surface is then more or less uniformly covered with a deposit of nickel, which is dissolved off with a rapid rinsing in a solution of nitric acid at 36° Bé, in the cold. When the emission of hydrogen is finished, in most cases at the end of 30 sec., the components are removed from the bath, washed copiously in running water and dried before the chromium plating.

Speaking generally, this type of solution gives good results on ordinary aluminium, on alloys containing either magnesium, such as Duralinox, or else magnesium and silicon, such as Almasilium. It is not suitable, on the other hand, for the copper bearing alloys of the Duralumin type.

Porosity Holes

When a cast alloy is being processed, it is necessary to ensure that the surface of the object is not pitted with scattered porosity holes, on which the electro-deposited chromium would have a tendency to form bridges which would prevent localised adherence to the base metal. This is the reason why the best results are generally obtained on chill castings rather than on sand castings.

It will obviously always be of advantage to conduct a preliminary research to develop an appropriate pre-treatment, such as stirring, so as to divide as far as possible the impurities throughout the whole of the metal mass, and thus to obtain a fine and regular attack on the surface. It may easily be seen, for example, that the attack of the bath will be exercised much more regularly on an object in which this has been done than one which has not been handled in this way.

In the first case, the fine texture of the eutectic, in multiple areas of the surface, is favourable to the keying of the deposit, while otherwise there is a coarser distribution of the constituents in the interior of the metal which favours the formation, during the pickling stage, of large cavities in which the deposit cannot adhere.

A micrographic examination was made of an Alpax cylinder block which was chromium plated after a surface treatment of this type. The manner in which the electro-deposited chromium had adhered

to the surface of the cylinder could very clearly be seen. In certain areas it had penetrated quite deeply into the interior of the metal, a feature which ensures an excellent adherence.

The second solution is composed of hydrochloric acid and of manganese sulphate. The quantitative composition is: HCl (22 Bé) 500 cc./tire; $MnSO_4$ 4 gm./litre.

The pickle cleaning is effected at 40°C. for a period of about one minute. The bath tends first of all to heat up when the component is immersed in it, then at the end of a certain period it commences to act more energetically and progressively loses its yellow coloration, following the precipitation of the manganese, and becomes a greyish colour.

The metal part treated having now become completely covered with a deposit of manganese, it should be withdrawn from the bath. The deposit of manganese is dissolved off before the chromium plating stage in a bath composed of three parts of concentrated nitric acid and one part of 50 per cent hydrofluoric acid, by a dip for a few seconds at 20°C.

Surface Corrosion

In certain cases, the nature of the composition can lead to a very marked surface corrosion. The content of HCl should then be reduced in the bath and the amount of manganese sulphate increased.

This second solution gives, when used for pickle cleaning on alloys of the Duralinox and Almasilium types, results that are not so good as the first solution previously considered, when a cast alloy is being processed, but better than when a forged, wrought or rolled alloy is being treated, such as sheets, for example. Good results are likewise obtained on ordinary aluminium but it is not suitable for the Duralumin type alloys.

The two types of solution discussed above present from the practical point of view the advantages that no toxic vapours are discharged during the processing and that no heating to a high temperature is required. They permit, in addition, of an easy control of the duration of immersion of the parts.

In order to ensure the maximum possibility of success with a procedure of surface preparation of this type before the chromium plating, too much emphasis cannot be placed on the necessity for abundant rinsing after each operation, for the corrosive solutions employed are capable of creating in several ways a bad adherence of the electro-deposited chromium if they are not completely eliminated from the base after the pickling process. Otherwise, if allowed to remain, they can upset the chromium plating bath. Also, their corrosive action can be continued in the plating electrolyte, and in this manner the deposited chromium can be separated from the base metal, leading to flaking or bad adhesion.

It must be pointed out also, however, that the rinsings should be effected with the greatest possible rapidity, so as to avoid passivation of the surface of the aluminium alloy by the formation of a fresh skin of oxide.

Composition of Electrolyte

As regards the chromium plating bath, it will be found that baths of the compositions normally employed (ratio CrO_3/SO_4 = 100 in gm. per litre) do not give satisfactory results after a surface preparation of this kind. It is necessary to use an electrolyte with a very low content of sulphuric acid. The following composition is the one that has been found to give the best results in practice: Chromic anhydride 250 gm. per litre; H_2SO_4 1.25 to 2.5 gm. per litre.

The ratio of the ions CrO_3/SO_4 being greater than 100, the deposits have a maximum adherence when they are produced at 50°-60°C. at a cathode current density equal to 40 amps. per sq. dm. The thickness of electrodeposited chromium under such conditions is of the order of 20 to 25μ per hour, and it is possible to achieve a chromium coating with a thickness of 1/10 mm. without giving rise to any flaking or peeling off of the deposit.

It is necessary to commence the metal deposition at a very high current density (60 to 80 amps. per sq. dm.), the over-voltage effect of hydrogen on aluminium being particularly low, and the starting surface also is markedly roughened.

A Chromium Cathode

The current density is reduced to normal values when the light alloy part has become covered with a thin, uniform coating of chromium, a stage which is generally reached at the end of some minutes after starting the plating. At this particular moment all the special conditions disappear, because one is then operating on what is, to all intents and purposes, a chromium cathode.

Time has not yet allowed of any detailed study being made of the behaviour in different atmospheres of chromium deposits on the light alloys, but it would appear that the direct chromium plating, with due regard to the particularly thick coating of the electrodeposited metal, constitutes a plating procedure which permits one to be particularly optimistic from this

aspect. On the one hand, there is the part played by the chromium as a corrosion inhibitor as regards the aluminium, a phenomenon which is well known, and on the other hand there is the absence of any very electro-positive coatings, such as copper, between the support metal in the light alloy and the deposited chromium, which diminishes to a very great extent any risks of corrosion.

Deposits of a few microns have given, for example, a remarkably protective power to the aluminium against attack by alkalis, and it is not an over-statement to say that it is a surprising fact if one considers the high porosity of electrodeposited chromium.

One cause of corrosion which must, however, be mentioned, because it happens frequently, is the following. As the chromium plating is always conducted on a surface containing numerous cavities, the bath electrolyte can remain in the pores after the plating and create an electrochemical action between the different constituents of the base metal, which, in the long run, will obviously cause the chromium coating to part from the base metal.

Avoiding Corrosion

This type of corrosion must be specially guarded against in the processing of castings which have faults such as cracks, fissures, etc. On sound parts, the best means of avoiding this type of corrosion consists of rinsing thoroughly the parts which have been chromium plated before they are dried.

The results described above show that hard chromium plating on the light alloys is an electroplating operation that is perfectly feasible and can give very good results, provided that at all times the operations are conducted in a rational manner. The method that has been developed is characterised by the employment (a) of pickle cleaning solutions that are specially corrosive and of a type capable of creating on the alloys superficial cavities favourable to the keying of the electrodeposited chromium; (b) a chromium plating bath of which the ratio of the ions CrO_3/SO_4 is higher than in the normal decorative chromium plating baths. The plating should be conducted in this bath at a high temperature (about 55°C.) and at a high current density.

It is probable that other methods of surface preparation would be found equally suitable before the hard chromium plating stage. As an example, microscopic examination of a section of a sample which had been chromium plated in Germany showed that the plating had been conducted on a

(*continued at foot of next column*)

surface which had been strongly pickled and presumably covered previously with another thin chemical deposit.

On the other hand also, anodic oxidation itself can give certain results, but ones which cannot compare in any possible manner, from the point of view of adherence of the chromium deposit, with those obtained by the chemical method described above. Microscopic examination of the structure of the keyed base of an electrodeposit on a part that had been anodically oxidised prior to plating showed that, in actual fact, there is no real bond between the plated coating and the base metal.

The deposited metal is not sufficiently anchored to the interior of the metal to allow of it resisting particularly severe stresses. This was so apparent that it was easy to detach the coating from the support metal.

There still remains quite a lot of work to be performed in the field of plated coating on the light alloys.

This subject is dealt with at length in "La Revue de l'Aluminium," Vol. 25, No 140, pp. 335-338.

CHROMISING STEEL

Improved Process Claimed

THE principles underlying the production of chrome steel surfaces on many industrial equipments are outlined in a report by Colvilles, Ltd., of Motherwell, Glasgow, of a process developed by the Metal Gas Co., Ltd. The report recalls that chromising is a chemical reaction which takes place at high temperatures on the surface of articles of ordinary steel, removing atoms of iron and replacing them with atoms of chromium.

The chromium penetrates into the steel to a depth of several thousandths of an inch to form a coating 30 per cent of protective chromium.

The stainless properties are only at the surface where they are needed, so that the total amount of chromium used is only a fraction of that required to make the articles from solid stainless steel.

An important feature of the process is that the change takes place without altering the dimensions of the article. For example, mild steel nuts and bolts can be "chromised" and will still fit easily.

Mechanical separation of the chromised coating from the articles is impossible since it is part of the article itself. It is so ductile and adherent that even the severest rolling, drawing or pressing operations do not damage it.

BORON HARDENING OF STEEL

Nature of Action in Various Alloys

AMPLIFYING the previous investigation which demonstrated that the effectiveness of boron in enhancing the hardenability of certain steels depended upon the form of the boron at the time of quenching, and not on the total amount of boron present (THE CHEMICAL AGE, *60*, 358-60), the U.S. National Bureau of Standards has since extended its research to include an investigation of the hardenability of alloys and steels with particular attention to the action of the boron.

This research has shown convincingly, the Bureau states, that the action of boron in increasing the hardenability is due entirely to a solid solution effect at heat-treating temperatures.

High-purity iron-carbon alloys containing 0.3, 0.5 and 0.7 per cent carbon and other high purity alloys containing 0.4 per cent carbon and 0.7 per cent manganese, each type with and without 0.002 per cent boron, were prepared for use in this investigation. In addition, several commercial and open-hearth steels (0.4 per cent C, 1.6 per cent Mn) were included.

Test Methods

Determination of the hardenability of the alloys was made in terms of the "critical cooling rate" (i.e., the slowest rate at which the alloy or steel can be cooled and be completely hardened); the standard end-quench test was used for evaluating the same properties of the iron-carbon-manganese alloys and commercial steels.

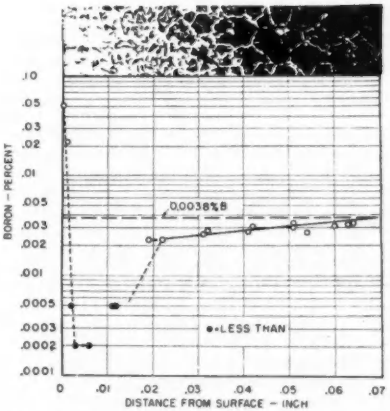
Specimens prepared from the alloys in the conditions as cast, as forged and homogenised, and as heat treated in various ways to precipitate a boron constituent were studied metallographically. Experiments were also made to determine whether boron was lost during the decarburisation of commercial steels and for determining the rate of diffusion of boron in austenite of these steels.

Small specimens of the alloys which were prepared from the ingots as cast, and also from bars after forging and homogenising, were quenched from various temperatures and a photographic record of the time-temperature relationship during the quench was obtained by means of sensitive galvanometer apparatus. The cooling time or rate so determined was correlated with the structure thus produced in the quenched specimen.

Since the hardenability of most steels is influenced by the size of the grains at the time of quenching, a determination was made of the grain size established at the quenching temperatures of each alloy and steel used in the critical cooling rate and end-quench tests. The general trend was for the hardenability of the alloys to increase (critical cooling rate decreased) as the size of the austenite grains increased.

To determine the primary effect of boron on hardenability, a comparison was made of the critical cooling rate of alloys of the same carbon content, without and with boron, when quenched from temperatures sufficiently high to ensure complete solution and uniform distribution of carbon in austenite of the same grain size.

With the forged and homogenised alloys, no significant improvement in hardenability was obtained by the addition of boron. With the alloys as cast, the hardenability was markedly improved by



Distribution of boron in a decarburised specimen of treated steel shown graphically and (top) by a photomicrograph. The left edge of the latter corresponds with the original surface of the specimen whose characteristic structure (not decarburised) is shown on the right. The graphical data was secured by spectrographic analysis at various depths. The normal boron content was .0038 per cent

the addition of boron with carbon content of 0.3 or 0.5 per cent, but the presence of boron in the 0.7 per cent carbon alloy again had no material effect on its hardenability. The observed difference in hardenability could not be ascribed to a grain-size effect.

The results of the tests made on specimens initially as cast showed that the boron-treated alloys containing 0.3 and 0.5 per cent carbon had about the same hardenability and this was greater than that of the 0.7 per cent carbon alloy. Thus, the effectiveness of boron in increasing the hardenability of these alloys decreased as the carbon content increased; the improvement due to boron was very pronounced with 0.3 per cent, intermediate with 0.5 per cent, and nil with 0.7 per cent carbon.

Limiting Factors

Since boron improved the hardenability of the two alloys (0.3 and 0.5 per cent carbon) in the initial condition as cast but was practically without effect after hot-working and homogenising, it is apparent that the action of boron on hardenability was adversely affected during the course of these treatments, probably by the exposure to the relatively high forging temperature.

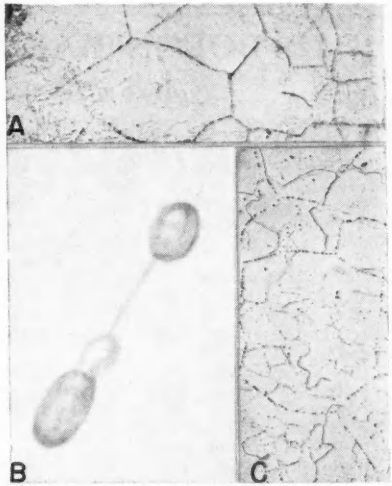
The action of boron in increasing the hardenability of steel is not definitely known, but tentative explanations have been reported in the literature. These theories may be classified on the basis that (1) the improvement is due to boron in solid solution in austenite, and (2) a reaction of boron with some other element to change the condition of the latter.

The Bureau's results and those published previously strongly support the conclusion that the effectiveness of boron in enhancing the hardenability of certain steels is due entirely to its action while in solid solution in austenite. Only the portion of the boron that is in solution at the time of quenching contributes towards an increase in hardenability.

The boron undissolved or in the form of compounds is either without effect, or possibly decreases hardenability by acting as transformation centres for austenite in the temperature range where pearlite is formed.

In addition to dissolving in austenite, boron can exist in steel in the form of compounds with nitrogen, oxygen, iron, and carbon. Some of these compounds are stable and are not decomposed at temperatures ordinarily used in the heat treatment of boron-treated steels. Other compounds containing boron may be partially or entirely decomposed at these temperatures.

When boron enhances the hardenability of a steel, it decreases the rate of nucleation and not the rate of growth of ferrite and carbide. The boron atom, believed to be located interstitially in the gamma iron lattice, is effective in retarding either (or both) the rate of formation of nuclei or the rate of their growth to the critical size necessary for transformation to begin.



A. This specimen (× 100) was heated to 2000° F. for three minutes, cooled to 1700° F. in a lead bath and quenched in sodium hydroxide solution. The left edge represents the original surface and the etching effect the boron constituent. B. The same specimen × 4000. C. The specimen (× 100) after reheating (1650° F. for five minutes) and quenched as before

A Versatile Measuring Instrument

Another Practical Application of Electronic Principles

THE accurate comparison measurement or monitoring of dimensions is assuming an increasingly important function in a diversity of chemical and metallurgical operations.

A proximity meter, which eliminates physical contact with the specimen and thus avoids wear and pressure inaccuracies, has been devised by Fielden (Electronics), Ltd., Manchester.

The instrument, type PM1, may be applied to any problem which can be resolved into a minute change in electrical capacitance relative to earth. The makers point out that this change may be produced either from a minute mechanical displacement or from a change in dielectric properties.

The approach of any substance, conductor, insulator, solid or liquid, will change the capacitance of the terminating electrode, and this change is recorded on the meter.

The Set Zero control knob enables the effective electrode capacitance to be balanced to zero at any value, and the other control knob adjusts the sensitivity of the equipment over a wide range.

Highly Sensitive

A self-contained portable unit is thus provided, capable of measuring very small increments of capacity relative to earth, with an accuracy depending only on the stability of the capacity potential dividing circuit.

Its application to industrial problems is made possible by the special cable which enables the measurement to be made at the point where it is needed with complete stability and freedom from extraneous influences.

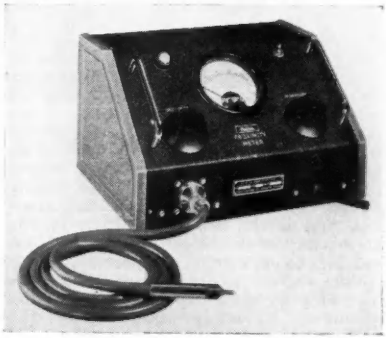
The physicist, the chemist or the engineer is rapidly becoming conscious of the physical, chemical and mechanical changes which can be conveniently measured as a change in electrical capacity, but unless he is a specialist in the electronics field he finds considerable difficulty in obtaining simple and stable equipment to make this measurement.

The proximity meter requires no specialised knowledge or skill for its operation.

Applications of this instrument are divided by the makers into two main fields:—

1. Where the user is dealing with conducting materials, when the instrument provides an invaluable method of dimensional comparison and measurement unsurpassed by any other means, *e.g.*, the measurement of strains in steel structures, machine tools, etc., the gauging of mass produced precision parts with greater accuracy than any other method and without wear and tear of the equipment; the monitoring of sheet metal, foil or wire sizes; the precision measurement of liquid levels (*e.g.*, a small metal band round the stem of a mercury thermometer enables a movement of 1/16 in. of the mercury column to deflect the instrument from zero to full scale).

2. Where the user is dealing with non-conducting materials, the instrument may be used for dimensional control where the composition is constant, or composition control where the dimensions are constant, *e.g.*, monitoring the thickness of plastic film, determining the moisture content of powders, etc., and comparing the dielectric properties of non-conducting liquids.



The new proximity meter (Type PM1)

Research Grant for St. Andrews

A covenant granting £2500 a year, less tax, for seven years (1949-55) to the United College of St. Andrews University was announced last week by Mr. John Rogers, deputy chairman of Imperial Chemical Industries, Ltd., on behalf of Lord McGowan and the board of I.C.I. The grant is to assist in the provision of residential facilities for post-graduate research workers and will not be confined to chemists or scientists, but will be available to all those engaged in original inquiry.

AMERICAN CHEMICAL NOTEBOOK

* * * * * From OUR NEW YORK CORRESPONDENT

ELOQUENT of the conversion of the search for radioactive minerals from a scientific activity to something like a national hobby is the new listing in mail-order house catalogues of a pocket Geiger counter, "the Sniffer," costing $54.50. This is a 2 lb. counter, operating on ordinary flash-light batteries and designed for general survey, monitoring, or prospecting purposes and is the newest addition to the wide variety of detecting instruments now available to uranium prospectors. It is the size of a folding camera, and is expected to replace expensive monitoring instruments in many cases where the location but not the exact strength of radiation must be determined. It is low in cost and very economical to operate, since it requires only two ordinary flash-light batteries for power, which generate 1200 volts. A growing army of amateur prospectors is seeking to capture the $10,070 reward, for each acceptable discovery of uranium deposits, offered by the U.S. Atomic Energy Commission. The instrument should also serve a useful purposed in classrooms for demonstration purposes, or in areas where formerly one expensive monitoring instrument was necessary.

* * *

Virtually the entire production of anhydrous ammonia and ammonium sulphate of the Phillips Chemical Company, Bartlesville, Oklahoma, is now available for commercial sale, according to the company's president. Having acquired the Cactus Ordnance Works, near Etter, Texas, on lease from the United States Army, in August last year, the company restored the existing anhydrous ammonia unit to its full productive capacity of approximately 230 short tons per day. A second unit is going into production shortly and by the end of August production will have been increased to a total of over 400 tons of anhydrous ammonia per day, or 120,000 tons of nitrogen per year. The company's other source of ammonium sulphate is at Port Adams on the Houston, Texas, ship canal, where operations started in January last now yield over 250,000 short tons per year of crystallised ammonium sulphate. With the additional ammonia capacity at Cactus, construction is progressing there for the manufacture of nitric acid, ammonium nitrate and nitrogen solutions.

Purified vegetable sterols in tonnage quantities are now available for the first time from Distillation Products, Inc., Rochester, New York. Refined from soya bean oil, the sterols are fine white crystals with a minimum purity of 95 per cent. They are soluble in acetone (2 gm./100 cc.), ethanol (2 gm./100 cc.), and ethyl ether (10 gm./100 cc.). They melt at 135°-138° C. and have a bromide number of approximately 500 gm./kg. In the past, the high cost of animal sterols has discouraged much research into commercial processes which would utilise the reported ability of sterols to stabilise oil-in-water and water-in-oil emulsions and to serve as raw material for the synthesis of surface-active agents, pharmaceuticals, and other chemical products. Inexpensive vegetable sterols are expected to stimulate further research in these fields.

* * *

The Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., has developed an improved cleaner for reverse current cleaning of zinc base diecasting prior to electroplating. The product, known as Pennsalt Cleaner Z-54, is for use after a pre-cleaning operation, such as spray washing, emulsion cleaning, or vapour degreasing. The company claims that greater current carrying properties and use at higher temperatures combine to make it highly effective in producing chemically clean surfaces and that the process results in substantial reduction in blistering.

* * *

Monsanto Chemical Company's sales for the six months ending June 30, 1949, amounted to $79,347,108, approximately the same as the figure for the corresponding period in 1948, according to Mr. Edgar M. Queeny, chairman of the board. Net income for the first six months of 1949, after provision for preference dividends, was equivalent to $1.72 per common share. This is one cent less than for the same period last year. Sales in the second quarter of 1949 are known to have been below those of January-June, 1948.

* * *

Under a one-year agreement recently concluded, Colombia is to receive $40,000 worth of chemical products and coal-tar dyes valued at $25,000 from the Netherlands, according to the U.S. Office of International Trade.

BRITISH STANDARDS FOR STEEL AND STEEL PRODUCTS. The British Standards Institution. B.S. Handbook No.10, 1949 edition. Pp.674. 25s.

National standardisation of industrial products in the United Kingdom had a beginning in 1901 with the adoption of a series of standard sections for structural steel. That fruitful start is recalled by the publication of the new handbook of the British Standards Institution, presenting in concise and comprehensive form the wide range of British standards for steel and steel products which have been registered since that time. The book consists of a number of descriptive articles which begin by outlining the principles of steelmaking, casting and forgings. There are notes on the use of steel for metal working and chemical plants and another article deals with blooms, billets, slabs and sheet bars and tabulates their qualities, chemical composition and purpose. The second part of the book summarises the various British standards which have been drawn up for the engineering and other heavy industries and explains the application of steel processes for pressure vessels, gas cylinders and galvanising. The excellent photographic and line illustrations substantially enhance the book's value to all interested in the manufacture and use of steel.

VORRAETE UND VERTEILUNG DER MINERALISCHEN ROHSTOFFE. Dr. Felix Machatschki. 1949. Vienna: Springer-Verlag. Pp. VIII+191. 20s.

It is probably a coincidence, but a fortunate one, that the appearance of this book coincided with the Fourth Mining and Metallurgical Congress in Great Britain. It deals with world resources and distribution of mineral raw materials, not confining itself to those found in the earth's crust. Some of the materials normally of mineral origin are also found in the atmosphere and water. Their function widens with the progressive needs and technical ability of science and industry. The author distinguishes three groups of minerals: (1) Those which are practically in inexhaustible amounts in all accessible parts of the globe, like gipsum, limestone, salt, as well as the air's contribution of nitrogen and argon; (2) Raw minerals which are abundant but unequally distributed, such as coal, iron ore, bauxite, magnesite, etc.; and (3) Minerals which demand specialised exploitation, such as the ores of heavy metals, asphalt and petroleum, phosphate, asbestos, mica, etc. The book presents a wealth of information, comparable with the recent publication by the U.S. Bureau of Mines "A Glossary of the Mining and Mineral Industry." It deals in detail with supplies and distribution of numerous minerals, and supplements its findings with statistics, tables, illustrations and references.

TASCHENBUCH FUER CHEMIKER UND PHYSIKER. Edited by J. D'Ans and E. Lax. 1949. Berlin: Springer-Verlag. Pp. VIII + 1896. £2 15s.

This is a most compact and much enlarged replacement of the once very popular Chemiker Kalender. It has been compiled with the assistance of many specialists who have brought the subject matter up to date. The contents are divided into the following sections: 1, Measuring systems and syllabus of subjects; 2, General constants according to atoms and molecules; 3, Macroscopic numerical values; 4, Astrophysics, geophysics and geochemistry; 5, Characteristic properties of materials; 6, Technical measuring; 7, Analysis; and 8, Mathematical tables. All these subjects are dealt with comprehensively in terms that can be understood by anyone interested in chemistry and physics. The authors have carried out the difficult task of collecting more than 800 tables and 350 line drawings and illustrations. They have furnished the book with information which could otherwise be obtained only by reference to a small library of special subjects. The thoroughness of the compilation and the high standard of presentation have resulted in a book of reference that should be of great assistance to all concerned with the fundamentals of chemistry and physics. Its scope is indicated by the fact that the subject index runs to 48 columns.

OBITUARY

Mr. *Charles Brotherton*

THE death was reported last week at his home, Kirkham Abbey, near Malton, Yorks, of MR. CHARLES FREDERICK RATCLIFFE BROTHERTON, for many years head of the chemical engineering firm of Brotherton & Co., Ltd.

Mr. Brotherton, who was 67, was the son of Mr. C. F. Ratcliffe and his wife Florence, sister of Lord Brotherton, who founded the great Leeds business, and whose name he assumed in 1931. He was educated at St. Xavier College, Bruges, and at Paris and Berlin.

From the time he joined the firm in 1904 until ill health caused him to resign the chairmanship in February this year, Mr. Brotherton showed an exceptionally keen appreciation of the possibilities for a great industrial enterprise to serve social and educational interests. His vision extended beyond his immediate employees, and in 1940 he set up a trust fund of £250,000 for the advancement of education, the furtherance of medical and surgical research, and for other charitable purposes in the cities of Leeds, Birmingham, Liverpool, Wakefield, and York, and the borough of Bebington, in Cheshire—the places in which the Brotherton factories are situated. He also gave £50,000 in 1942 to Leeds General Infirmary to cover the cost of a wing for paying patients.

In 1944 Mr. Brotherton agreed to subscribe £1000 a year under deed for seven years for the establishment of a research fellowship in chemistry at Leeds University and a further £1000 a year for seven years for a lectureship in chemical engineering. He provided a further £2000 for equipment. The next year he gave to Leeds University £5000 to establish a laboratory of chemical engineering and a further £50,000 payable in the ensuing 10 years for the same purpose.

At the end of last year he contributed £1200 to enable the great East Window of York Minster to be re-leaded and replaced.

His business frequently took him abroad, and he was for years as much at home in Brazil and the Argentine as at Leeds, although he was never happier than at home in his native county.

Besides his numerous public gifts, he loved to make life easier for others and gave much away privately.

On his retirement he was succeeded by his younger brother, Captain Bertram Ratcliffe.

Personal

DR. I. M. RABINOWITCH, director of the Institute for special research and cell metabolism of the Montreal General Hospital, has been awarded $10,000 by the Sugar Research Foundation, Inc., New York, to continue his investigations on carbohydrate metabolism. The doctor, who has received $52,500 in grants from the foundation since 1946, will make a report on his studies in an address to the American Chemical Society, in Atlantic City, next month.

MR. JOHN W. STEVENS has been appointed director of sales of the chemical division of Celanese Corporation of America, to be responsible for the sales of organic chemicals produced at the Chemcel plant, Bishop, Texas.

VISCOUNT LEVERHULME, governor of Lever Brothers and Unilever, Ltd., left gross estate provisionally valued at £2,357,039, on which estate duty of £1,656,475 has been paid.

Argentine Oil Fuel

Dr. Zanetta, a director of the Argentine Government monopoly oil company "Y.P.F.", states that the country's fuel deficit will amount to 9.5 million cu. m. by 1951, in which year home requirements will total 14 million cu. m. and home production no more than 4.5 million cu. m. Imports and the supplies envisaged under the treaty with the U.K. (7.2 million tons) will not be sufficient to close the gap. The further development of the Argentine oil industry is being much hampered by the lack of drilling equipment.

HOME

An Export Record

Record bicycle and motor cycle exports worth nearly £15 million in the first half of 1949 are £2.5 million higher than in the first half of 1948.

Cast Iron Sectional Tanks

A new British Standard (1563:1949) deals with cast iron sectional rectangular tanks for the bulk storage of liquids. Those covered by the standard are made up from 2, 3 or 4 ft. sq. unit plates bolted together, giving depths of 2, 4, 6, 8, 10 and 12 ft., with capacities from 280 to 75,000 gal. The standard offers 11 tables and four half-tone illustrations.

High Raw Materials Costs

The high prices charged by the Board of Trade for materials and the relatively low cost of manufactured paper fixed by control are stated to be the causes of the enforced closing down of the 70-year-old papermill at 296, Springfield Road, Glasgow, owned by Brown, Stewart & Co., Ltd. The firm has decided to concentrate production at the Kelvindale Mill, Glasgow, a branch of the Associated Paper Mills combine.

Steel Developments Deferred

Lord Riverdale, principal of the Sheffield steel-making firm of Arthur Balfour & Co., Ltd., said last Sunday in an interview that his company's large schemes of extension contemplated had been suspended because it was not known what was going to happen under nationalisation, although the firm was not included in the Government's steel nationalisation proposals. Smaller schemes to bring the works up to date were continuing, he said.

Census of Production

The Board of Trade announces that information is to be collected in less detail for the census of production for the year 1949 than that for the year 1948. For example, only one total figure will be required for work given out and the sections on payments for services rendered by other firms (*e.g.*, advertising, research) and an analysis of sales will be omitted. Although certain simplifications will be made for 1949, details similar to those asked for in 1948, particularly for the sections on materials purchased, and output, will be required at future censuses. Firms are therefore advised to maintain the records of their business which enabled them to complete the census forms for 1948.

New Clayton Laboratories

New laboratories are to be erected by the Clayton Aniline Co., Ltd., at Ashton New Road, Manchester.

Safety Group

Mr. Vernon Gordon and Mr. D. Brown, both of the North British Rubber Company, have been elected vice-chairman and treasurer, respectively, of the newly formed Edinburgh and South-East Scotland Industrial Safety Association, comprising workers and trade union officials.

Chemical Production Levels

The provisional index of industrial production in April and May, prepared by the Central Statistical Office, discloses that the relevant figure for chemicals and allied trades in the former month was 123, compared with 124 in the first quarter of the year and the last quarter of 1948. Production in mid-1948 was represented by the figure 115.

Hormones in Horticulture

The use of hormone-impregnated flower pots made of peat, whereby the plants derive the dual advantage of encouraged growth and undisturbed potting and expansion, has been developed in Scotland by Universal Pulp Containers, Ltd., of Milton of Campsie. These will be shown at the forthcoming Scottish Industries Exhibition in Glasgow next month.

Steel Development Continues

Government approval has been secured for a £500,000 scheme by Richard Thomas and Baldwins, Ltd., to construct at Machynis a new engineering works which will be the most modern in Wales. The plant will ultimately employ 650 people—200 more than were engaged at Nevill's Foundry, which the venture would replace.

A Widnes Memorial

A memorial to the 42 men of Imperial Chemical Industries' Widnes works who lost their lives in World War II, was unveiled by the chairman of the general chemicals division, Mr.G. K. Hampshire, in the hall of the I.C.I. Recreation Club, Liverpool Road, Widnes, on July 30. The memorial, a bronze plaque set in the hall entrance, is to 15 men of Gaskell Marsh Works, 10 of Widnes laboratory and 17 of Pilkington Sullivan works. The unveiling ceremony was performed by the Rev. G. Woodcock, vicar of Kirkdale, Liverpool, formerly senior chaplain to the 55th Division.

SULPHUR REVIVAL

2 Milliard Lire Project in Sicily

TO overcome the difficulties of the Sicilian sulphur mining industry which in 10 years have brought about a severe decrease in production and sales, the mine owners have evolved a comprehensive modernisation scheme involving the expenditure of about two milliard lire.

By utilising sulphur anhydride—which has so far been lost—for the manufacture of sulphuric acid, the mine owners hope to achieve a more economic working of the sulphur deposits. The sulphuric acid thus produced is to be the starting material for five new factories for the manufacture of chemical fertilisers and other products to be erected in Sicily at a cost of about 20 milliard lire. Special attention is to be paid to the production of superphosphate fertiliser, conditions for which are held to be particularly favourable in view of the proximity of the large North African deposits.

After re-equipment and modernisation, it is anticipated that output in the existing sulphur mines can be stepped up to over 250,000 tons per annum, which is approximately equal to the pre-war output. 20,000 men will eventually find employment in the sulphur mines, as compared with some 10,000 at present.

COPPER PROSPECTS IN ITALY

ITALY has long been grappling with problems connected with the dwindling capacity of her natural copper resources.

There are a number of mines spread over the northern part of the country, but most of these have been practically exhausted, or their metal output is so poor as to make it impracticable to continue working them.

In Sardinia, where the search for copper has been energetically pursued during recent years, known ore resources have been stated to be these:—

	Estimated ore tons	Metal percentage	Total metal tons
Funtana Raminosa (Nuoro)	200,000	2	4,000
Demus Novas (Cagliari)	250,000	4.5	11,250
Bau Arenas (Nuoro) ...	30,000	5	1,500
Talentiu ...	20,000	5	1,000
Barisone (Sassari) ...	20,000	5	1,000
Li Menduli (Sassari) ...	14,000	3	420

This indicates a total reserve of nearly 20,000 tons of copper which, although small by world standards, is currently a valuable asset. Plant is being erected in Sardinia for the electrometallurgic processing of the copper-bearing ore.

NEW TITANIUM SOURCES

Development in the U.S.A.

THE titanium industry in the U.S.A. in 1948 continued to establish new production and consumption records, according to the U.S. Bureau of Mines.

Since before the war the titanium picture has altered considerably. India was then supplying U.S. consumers with most of their ilmenite, the chief source of titanium. War disruption of ocean shipment, however, gave impetus to the search for alternate supplies. Now the U.S.A. has the largest single ilmenite-producing mine in the world, property of the National Lead Company at Tahawus, New York. Other new properties are in production, plan to produce in the near future, or are being investigated.

Doubtless the prospective need for nearby sources, capable of assuring large tonnages of titanium-bearing ores, anticipating the time when the metal would come into large-scale production, was a contributory factor in the development of new sources of supply.

In this connection the announcement in 1948 that the Kennecott Copper Corporation and the New Jersey Zinc Company were to exploit a very large deposit of ilmenite in Quebec, Canada, was an outstanding event of the year. (THE CHEMICAL AGE, *60*, 145).

Titanium from this property is destined for pigment purposes in the early days of production, but the operators are looking forward to an eventual large market for metal manufacture.

Foreign Suppliers

Receipts of ilmenite in 1948 fell 20 per cent below the record of the previous year. India was, as usual, by far the chief source of imported concentrates, supplying 76 per cent of the total in 1948 compared with 87 per cent in 1947. Norway supplied 17 per cent of the 1948 total, while remaining imports came from Australia, Brazil, and British Balaya. Ilmenite imports in 1948 totalled 242,119 short tons, valued at $1,758,838.

In 1948 Australia was the only country to ship rutile to the United States. Her shipments totalled 8771 short tons, valued at $588,713.

Vienna Fair

The 50th International Fair to be held in Vienna from September 11 to 18 will include a separate division for chemical and pharmaceutical preparations and a technical fair.

· OVERSEAS ·

Oil Drilling Suspended

Exploration work has recently been suspended in some of the concessions owned by foreign oil companies operating in Colombia. The quantities of oil discovered have in many cases been insufficient to warrant commercial exploitation.

Spanish Nylon

A factory is to be established in Barcelona to manufacture nylon yarn under an American licence from E.I. du Pont de Nemours & Company (U.S.A.). The large output of nylon articles in Spain at present depends upon imported yarn.

S. American Paper Projects

The Government of Argentina is to undertake extensive afforestation work intended to ensure supplies of wood-pulp for new paper mills. The Paranà pine is said to grow well in the territory of Misiones.

Fluctuating Production of Aluminium

A decline in the production of aluminium in Italy has been registered in the first quarter of this year, due chiefly to shortage of electric power. Production has now revived, in May the output having reached some 4000 tons, thus exceeding in one month the whole output of the first three months of the year.

Synthetic v. Natural Pyrethrum

The Pyrethrum Board of Kenya has stated that no adverse effects on the marketing of pyrethrum flowers in March, 1951, are expected as a result from the synthesising in the U.S.A. of the active principles of this insecticide material. The board has recommended growers to increase their 1948 acreages by 25 per cent during the coming rainy season, if labour conditions permit.

W. German Oil Refineries

Oil production in the Emsland district of Western Germany, near the Dutch frontier, has risen appreciably in recent months, states the Dutch economic daily paper *Economische Voorlichting*. Latest drillings have indicated rich occurrences of oil in the western part of Niedersachsen. As the available refinery capacity is proving insufficient for the constantly increasing crude output, plans are being considered for the erection of several large refineries, one in the Emsland and another with an annual capacity of 400,000 tons of crude at Stadersand on the lower Elbe.

French Steel Output

Production of raw steel in June totalled 767,000 tons, compared with 809,000 tons the previous month. The highest monthly output this year was attained in March—825,000 tons. Pig-iron production in June also showed a decrease, to 717,000 tons against 756,000 in May.

French Mineral Deposits

Barium oxide seams have been found in the Bidarray region (Lower Pyrenees) where, with the very pure barytes, are minerals comprising a mixture of barium sulphate and carbonate. The presence of barytes had formerly been noted in the Drome, but has not been revealed by recent work. Exploitation of graphite shale found near Chateaubriand is about to be resumed, having been stopped at the beginning of the war. In some locations the graphite content is so high that it might be possible, with appropriate treatment, to produce a good industrial graphite.

Four More Reactors

FOUR new reactors for the controlled release of atomic energy form part of the development scheme of the U.S. Atomic Energy Commission.

Two will be commissioned and construction started within the next two years, according to Mr. Sumner T. Pike, in a recent address at Bowdoin College, Maine. The first will probably be near Arco, Idaho.

Two more would be begun in another two or three years.

The world's most advanced atomic reactor is in Canada, according to Dr. Hafstad, director of reactor development for the Atomic Energy Commission. In an address to the Institute of Aeronautical Sciences at Los Angeles, the doctor said that no greatly improved types of reactors had been built in the U.S.A. since the war.

A FORTNIGHTLY feature service for the world Press devoted to science, education and culture has been started by the United Nations Educational Scientific and Cultural Organisation. Text will be in English, French and Spanish.

Law and Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH LIGNITE PRODUCTS, LTD., Bovey Tracey. (M., 6/8/49.) June 29, £5000 debenture, to George Wimpey & Co., Ltd.; general charge. *Nil. December 7, 1948.

SOUTHERN CHEMICALS, LTD., Dublin. (M., 30/7/49.) June 15, £25,000 debenture to the Industrial Credit Co., Ltd.; charged on the deep water quay and large store thereon beside the River Deel, Askeaton, Lower Connelloe, Co. Limerick, also general charge. *£1000. March 26, 1948.

SOUTHERN INSTRUMENTS, LTD., Camberley, manufacturers of scientific instruments. (M., 6/8/49.) June 28, debenture, to C. Hoare & Co., London, securing all moneys due or to become due to the holders from the company; general charge. *Nil. December 31, 1944.

T. WHEELER (SCIENTIFIC INSTRUMENTS), LTD., London, E.C. (M., 6/8/49.) June 30, charge, to Westminster Bank, Ltd., securing all moneys due or to become due to the bank; charged on land known as 217 Goswell Road, and 1 Goswell Terrace, E.C.1. *£300. January 26, 1949.

Satisfactions

MARSDENS (PRECISION TOOLS), LTD., Farnworth. (M.S., 6/8/49.) Satisfaction June 27, of debenture registered October 4, 1948.

NORTHERN OIL CO., LTD., Nottingham. (M.S., 6/7/49.) Satisfaction June 27, of debentures registered February 21, 1938.

REYNOLDS SCIENTIFIC GLASS WORKS, LTD., London, S.E. (M.S., 6/8/49.) Satisfactions July 5, of mortgages registered December 19, 1947, and May 3, 1949.

Company News

The following increases in capital have been announced: E. WOOD, LTD., paint makers, from £100,000 to £150,000; BURRELL & CO., LTD., colour and varnish manufacturers, from £100,000 to £300,000, VARNICOLOUR, LTD., manufacturers of varnishes, oils and colours, from £100 to £2,000. ARTHUR HOLDEN & SONS, LTD., from £110,000 to £150,000.

Change of Address

The address of the directorate of SUNDRY MATERIALS has been changed to Empire House, St. Martins-le-Grand, E.C.1.

Texas City Action

THE disastrous explosion which laid waste a large part of Texas City following a fire in two fertiliser ships two years ago (THE CHEMICAL AGE, 56, 497), is recalled by the slow progress of the $200 million law suit against the United States Government, which is in session at Houston and Galveston. The testimony is voluminous and it seems that several months will elapse before the concluding evidence can be presented. This court action deals solely with the liability of the United States Government in the inspection of the loading of ammonium nitrate. No evidence has been presented in connection with tests that were made after April 16-17, 1947.

Abuse of "C" Licences Denied

The "C" licence has been "the target for a great deal of comment, much of it from sources apparently not well-informed," says the annual report of the London and Home Counties Area of the Traders' Road Transport Association, the national organisation for C licence-holders. "This serves to stress the necessity for the greatest vigilance to ensure that all steps necessary to uphold the interests of the C licence-holders are taken," it says.

"Earlier in the year there was some revival of charges of illegal operation by C licence-holders, and in publicly stating its belief that there was no serious degree of illegal operation, the association offered to investigate fully any cases brought to its notice. The insignificant response to the offer confirmed that there was no substance in the allegations."

The Stock and Chemical Markets

THE heavy fall in British Funds has continued to overshadow stock markets where some uneasiness is associated with the belief that the Government will have to take more steps in September to prevent further big drains on gold and dollar reserves. At the time of writing, gilt-edged stocks have made no recovery from the heavy falls of last week, but industrial shares are steadier. Prices are inclined to move sharply on only moderate buying or selling.

Chemical and kindred shares reflected the general trend, but were mostly lower on balance. Thus Imperial Chemical were 42s. 3d., Fisons 44s., and Albright & Wilsons 28s. Monsanto, however, have been maintained at 51s. 3d. British Glues & Chemicals 4s. ordinary eased to 18s. 6d., and Boake Roberts 5s. shares were lower at 29s. on the reduced profits, although the dividend is again 30 per cent. Elsewhere, W. J. Bush ordinary shares remained firmly held and quoted at 77s. 6d. on the financial results and higher distribution of 14½ per cent (comparing with 12 per cent for the previous year).

Lever & Unilever have been steadier around 42s. 6d. with Lever N.V. at 43s. 3d.; Dunlops were uncertain at 60s. 3d., Turner & Newall 73s., and General Refractories 23s. 4½d. Borax Consolidated have been steadier at 50s., also British Aluminium at 43s., British Oxygen at 92s. 6d., and Triplex Glass 10s. shares at 20s. were within a few pence of the level a week ago.

Despite market expectations of an eventual bonus, Glaxo Laboratories at £17½ were lower on balance. Boots Drug were slightly down at 47s. 9d., and British Drug Houses 5s. shares 7s. 3d. United Molasses (38s. 3d.) were inclined to attract attention, following their recent fall, in recognition of the fact that the company is a substantial dollar earner. British Match have been steady at 32s. 3d. and there was again a firmer tendency in shares of companies connected with plastics, although De La Rue at 26s. 6d. attracted profit-taking and receded from the high level created by the good financial results. British Xylonite were 65s., British Industrial Plastics 2s. shares 4s. 10½d., and Kleeman 10s. 3d.

In iron and steels Firth Brown were weak at 68s. 1½d. Dorman Long were 28s. 6d., United Steel 26s. 6d., and Stewarts & Lloyds 53s. 3d. Whitehead Iron, however, rallied to 111s. 3d. Elsewhere, Guest Keen receded to 36s. 3d., Babcock & Wilcox 56s. 3d., and Staveley 76s. 6d.

There has been a better tendency in Beechams deferred at 12s. 6d., Sangers were 29s., and Griffiths Hughes 18s. 1½d. Ilford 5s. ordinary were firm at 21s., and Laporte Chemicals 5s. shares kept firm at 21s. 3d., while Amber Chemical 2s. shares were 5s. 7½d., and Bowmans Chemicals 7s. General Electric, however, came back to 81s. 6d. on the financial results. There was only a very small business in oil shares and, with sellers predominating, prices moved lower.

Market Reports

ACTIVITY on the industrial chemicals market has been somewhat subdued during the past week due, no doubt, to the influence of holidays. Buyers, moreover, are showing a tendency to limit themselves to short-term period buying. There is no lack of interest in the soda products section and potash chemicals continue firm. Owing to an increase in the price of pig lead, the prices for white lead and red lead have been advanced to £112 5s. per ton and £102 per ton respectively. The coal tar products market remains unchanged, with a fairly good demand reported for pitch and naphthalene.

MANCHESTER.—Trading, so far as new bookings are concerned, has been quieter on the Manchester chemical market during the past week. This is attributable largely, although not entirely, to holiday influences. Another factor which tends to restrict dealings in one or two lines is uncertainty regarding prices, the effect being to limit fresh transactions as far as possible to early needs. Actual movements into consumption, allowing for seasonal influences, keep up fairly well.

GLASGOW.—The Scottish chemical market has continued to operate on a diminished scale, but order books for delivery after the holidays have been well filled. No unusual demands have been noted. Indications are that the turnover will gradually rise during the next two or three weeks to the previous level, as most of the larger users of chemicals are fairly busy; a reasonably satisfactory volume of business may be expected. There has been a steady increase in the local demand for various grades of toluene over the past few months, and it seems likely that this will continue.

Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Chlorinated polymers.—E. I. Du Pont de Nemours & Co. May 17, 1946. 623,705.

Process for the preparation of steel of high quality.—C. Coli. Dec. 9, 1940. 624,165.

Methods of improving permanent magnet alloys.—British Thomson-Houston Co., Ltd. July 29, 1943. 624,166.

Process of and apparatus for the manufacture of phosphate fertilisers.—Soc. Anon. des Manufactures des Glaces et Produits Chimiques des St.-Gobain, Chauny & Cirey. March 6, 1942. 623,989.

Process for the dehydration of acetic acid and other lower fatty acids.—D. F. Othmer. Feb. 17, 1941. 623,991.

Liquid vinyl resin dispersion process and product.—H. J. Fitzpatrick (Advance Solvents & Chemical Corporation). Dec. 22, 1945. 624,079.

Textile products.—Imperial Chemical Industries, Ltd., and A. H. Little. Feb. 15, 1946. 623,805.

Froth flotation process and flotation agents therefor.—National Chemical Products, Ltd., and R. F. Powell. Feb. 21, 1946. 623,994.

Cellular glass and the formation therefor.—Pittsburgh Corning Corporation. April 24, 1945. 623,806.

Glass mixtures and process of forming same.—Pittsburgh Corning Corporation. April 26, 1945. 623,807.

Cellular glass and process of forming same.—Pittsburgh Corning Corporation. April 24, 1945. 623,808.

Manufacture of articles of thermoplastic synthetic resins.—S.P.A. Lavorazione Materie Plastiche. June 21, 1944. 624,174.

Preparation of N-(pyrimido (4.5-b) pyrazemethyl) amino-phenyl compounds and intermediates thereof.—American Cyanamid Co. Jan. 15, 1946. (Cognate Application 13482/46.) 623,809.

Manufacture of organo-silicon compounds.—Corning Glass Works. Nov. 15, 1945. 624,086.

Preparation of emulsions of polymeric organic polysulphides.—B. F. Goodrich Co. June 13, 1945. (Cognate Application 15534/46.) 623,996.

Insecticidal compositions. — Hercules Powder Co. Aug. 4, 1945. 624,176.

Manufacture of dyestuff intermediates of the anthraquinone series. — Imperial Chemical Industries, Ltd., S. Coffey, F. Lodge and J. Wardleworth. May 27, 1946. 623,997.

Manufacture of dyestuff intermediates of the dibenzanthrone and isodibenzanthrone series. — Imperial Chemical Industries, Ltd., S. Coffey, F. Lodge and J. Wardleworth. May 27, 1946. 623,998.

Means for controlling the mixing of hot and cold fluids.—Walker Crosweller & Co., Ltd., and C. L. Barker. July 11, 1946. (Cognate Application 11209/47.) 623,811.

Electric furnaces for the manufacture of glass, or the like.—J. Finger. July 23, 1946. 624,002.

Manufacture of titanium pigments.—National Titanium Pigments, Ltd., J. T. Richmond and R. J. Wigginton. Aug. 16, 1946. 623,813.

Production of solutions of organic bases.—Permutit Co., Ltd., and W. G. Prescott. Aug. 16, 1946. 624,008.

Thermostatic mixers for liquids. — R. E. L. Trubert. June 2, 1942. 623,814.

Catalysts for use in the synthesis of hydrocarbons.—J. C. Arnold (Standard Oil Development Co.). Aug. 23, 1946. 623,815.

Preparation of polychloroprene cements. —E. I. Du Pont de Nemours & Co. Sept. 15, 1945. 624,012.

Manufacture of amines and quaternary ammonium salts.—Ciba, Ltd. Oct. 4, 1945. (Cognate Application 28557/46.) 624,101.

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Crystallising potassium phosphate.—Standard Telephones & Cables, Ltd. July 31, 1945. 624,105.

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